

I. Surveillance in Occupational Illness and Injury: Concepts and Content

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The Nature and Purpose of Surveillance Programs in Occupational Health

Epidemiologic surveillance is the ongoing and systematic collection, analysis, and interpretation of data related to health. This information is used to plan, implement, and evaluate public health interventions.¹ Occupational surveillance programs identify instances of illness, injury, or excessive exposure and monitor trends in their occurrences across different industry types, over time, and between geographic areas.²

Case identification may benefit not only the affected individual but also his or her co-workers. For example, identifying a case of lead poisoning should not only remove the worker from exposure, but also should lead to screening of co-workers to identify and manage other cases. Thus, the case represents an Occupational Sentinel Health Event.³ If case identification is followed by a worksite evaluation, exposure hazards can be controlled. Although the term "case" is typically used to designate an instance of a disease in a person, the individual occurrence of an acute occupational injury, excessive absorption of a toxic substance, or excessive personal exposure are all events that have been placed under surveillance. Identification of such "cases" can result in significant benefits to the individual.

Trend monitoring is essential in evaluating the overall effectiveness of worksite control programs. Increased rates of injury, illness, or exposure identify targets for enhanced worksite intervention. In targeting intervention programs, surveillance directs "the most important ethical decision in public health": the appropriate allocation of resources.⁴

In public health, the term "surveillance" has a broader meaning than is indicated by its usage to describe certain occupational health programs. In occupational health, the term "screening" should be used to describe programs that include a medical history, physical examination, and laboratory tests to detect a specific disease process at an early, potentially reversible stage.^{5,6} As discussed in this article, medical screening is one type of surveillance activity. Under Occupational Safety and Health Administration (OSHA) standards, a primary purpose of medical surveillance is to

detect affected individuals through screening.⁷ Surveillance includes a wider range of activities than is required for most OSHA standards.⁸

Health Surveillance

Data Sources

A variety of data sources have been used to monitor trends of occupational illness and injury. These include: employer reports, death certificates, birth certificates, Workers' Compensation records, clinical laboratory data, medical examiner reports, hospital discharge records, and national health surveys. Typically these databases were developed for purposes other than surveillance and have important limitations.² Some hold promise for monitoring selected conditions in individual states (e.g., blood lead test results collected by state laboratories). Others hold promise for more intensive surveillance efforts (e.g., the National Health Interview Survey).

Case Identification

Two types of programs exist that identify cases of occupational illness or injury. Screening programs and health-care-provider reporting programs are designed to identify individuals so that action can be taken. Screening programs are often mandated by OSHA standards covering exposure to specific workplace hazards (e.g., lead and cotton dust). Under such standards, employees are required to perform screening to identify individuals with evidence of excessive absorption of a toxic agent or organ system dysfunction and remove them from exposure to the offending agent. Although such programs are in wide use, standardized screening techniques are available for only a very limited number of applications.

Most states have regulations that require reporting of occupational disease to an agency of state government.⁹ However, most programs are not effective due to strong disincentives for physicians and others to report occupational diseases.^{2,9} Follow-up of cases that are reported to state government is infrequent. Finally, absence of clear case

NOTE: Author affiliations and addresses are listed on p. 7.

definitions for occupational disorders has created ambiguity in reporting criteria and nonuniformity of reports.

Trend Monitoring

Employer Reporting—The Annual Survey of the Bureau of Labor Statistics

The largest national program to monitor trends in the occurrence of occupational disease and injury is the Annual Survey of the Bureau of Labor Statistics (BLS). This survey utilizes employer reports to estimate annual rates of occupational disease and injury for the United States. These estimates are used regularly to characterize the effectiveness of control programs, particularly those of OSHA.

The BLS Annual Survey has been criticized for underestimating the true burden of occupational illness and injury.¹⁰ Such underestimation may result in distortion of information needed for control program evaluation and in inadequate support for such programs. As a result of these concerns, BLS is currently restructuring the Annual Survey and other BLS surveillance programs. Despite the limitations of the Annual Survey, much useful data are available, particularly for acute traumatic injuries.

Surveillance Based on Death Certificates

As discussed elsewhere in this monograph (see chapter IX), death certificates provide a uniform database for monitoring trends in the occurrence of selected occupational disorders. The utility of this approach is limited by the quality of the occupational history as recorded on death certificates. Furthermore, mortality records, by definition, do not detect nonfatal conditions. Finally, most fatal conditions that are caused by work can also be caused by other factors.

Despite these limitations, death certificates can be very useful in surveillance. One of the best demonstrations of such usefulness is the NIOSH National Traumatic Occupational Fatality (NTOF) Database. Using certificates from all 50 states and the District of Columbia, this database currently provides a comprehensive estimate of US fatality rates due to occupational factors. (See chapter VIII in this monograph.)

Exposure Surveillance

Measurement of airborne contaminant concentrations in the workplace has been used for many years to evaluate the efficacy of engineering controls for limiting exposure to toxic substances. Such sampling is also used to identify work areas or individuals with excessive exposure that requires further action. When sampling results are collected by or provided to OSHA or the Mine Safety and Health Administration (MSHA), a valuable database becomes available for surveillance purposes. (See chapter VI in this monograph.)

To estimate worker exposure, NIOSH has conducted direct surveys that use an inventory of workplace products and observations of work practices. (See chapter VII entitled Hazard Surveillance in NIOSH.) Although limited by the lack of direct exposure measurements, these surveys provide a representative sample of potential exposures in US workplaces.

Evaluating the Utility of Surveillance Programs

The Centers for Disease Control has recently developed principles by which surveillance programs can be evaluated.¹ These principles can be applied, with some modification, to surveillance efforts in occupational health.

Efficacy of case identification surveillance programs is best described by quantification of the benefit to the individual case, his or her co-workers, or improvements in the work environment. These benefits can be considered using traditional prevention concepts. Primary prevention will prevent further exposure to the nondiseased. Secondary prevention will prevent progression or result in mitigation of mild disease. Tertiary prevention will lead to rehabilitation or mitigation of more severe disease. In some instances of secondary prevention (e.g., lead toxicity or carpal tunnel syndrome), the adverse effects are at least partially reversible after exposure to the hazardous substance or activity has stopped or after appropriate medical management has been instituted.¹¹ In other situations (e.g., noise-induced hearing loss or silicosis), progression of disease due to continued exposure is prevented by removing the worker from contact with the offending agent, an example of tertiary prevention. Unfortunately, there are only a few situations where case detection can lead to medical intervention, as in screening for bladder cancer among workers exposed to a bladder carcinogen.

Evaluation of occupational surveillance systems that focus on group results to monitor trends can be performed using general public health principles.¹ Timely reporting of surveillance results is essential if results are to be used to modify control programs. Accurate and representative data must be obtained to ensure the credibility of results. Since trends are to be compared over time and place, consistency of data collection and analysis is essential.

Trends in Surveillance Programs

The limitations in surveillance systems described have been acknowledged by many groups including the National Academy of Sciences¹⁰ and the Congress of the United States.¹² To address these limitations, researchers have over recent years made significant improvements in many aspects of occupational health and exposure surveillance. These positive trends in program development are encouraging and indicate the direction of future work.

Strengthened Morbidity Surveillance

In the past, surveillance systems in occupational health have relied heavily on mortality records. However, since most occupational conditions manifest as nonfatal outcomes, surveillance systems have been developed to focus on morbidity rather than mortality. Of particular importance in this regard are worker surveys, discussed in chapter II of this monograph.

Method Standardization

Questionnaires and diagnostic tests used in surveillance programs are being standardized to improve the reproducibility of survey results, as Ehrenberg and Sniezek point out in chapter III. Case definitions are being developed to standardize provider reporting, as addressed by the authors of chapter V. As standardization improves, reproducibility of results will improve proportionately.

Improved Employer Reporting

OSHA citations of employers for inadequate medical recordkeeping have received national attention and may improve the quality and representativeness of employer-generated health reports. Although of limited utility in disease surveillance, employer reports of injuries provide an

important source of surveillance data. Hanrahan and Moll focus on this important concern in chapter VIII.

Strengthened Infrastructure

With NIOSH support and increased activity at the state and local level, the capacity for state health departments to conduct occupational health surveillance has been strengthened. Through such programs as SENSOR, state governments are becoming more actively involved in surveillance. Some states (e.g., New York) have linked surveillance activities to a network of occupational health clinics to provide a more comprehensive approach to prevention. Baker discusses the concept of SENSOR (Sentinel Event Notification System for Occupational Risks) in chapter IV of the monograph, while Welch delineates the role of the networking clinics in chapter XI.

Improved National Surveys

Through collaboration among the various federal agencies (NCHS, NIOSH, and BLS) existing national surveys have been expanded to address occupational health concerns. (See chapter III for details on these collaborative efforts and development of the standard questionnaire for occupational health research.) The 1988 National Health Interview Survey (NHIS) included a substantial supplement on occupational health. The National Health and Nutrition Examination Survey (NHANES), currently in the field, is also collecting data relevant to occupational disorders. Other NCHS surveys provide similar opportunities.

Improved Exposure Surveillance

By targeting specific industries, existing exposure data for the Mine Safety and Health Administration (MSHA) or OSHA are being used to monitor exposure trends. For example, NIOSH analyses of MSHA data on exposure to coal dust in long-wall mining revealed that exposure levels in certain jobs have increased over recent years. Soon after receipt of these analyses from NIOSH, MSHA provided new

guidance to compliance officers that will target exposure sources identified through exposure surveillance.

Conclusion

Surveillance in occupational health is a complex process. Programs are performed for a variety of purposes by many groups. No single approach to surveillance is able to address the complex needs of the field of occupational health and safety. Recent improvements in data systems and their use have identified new ways to use surveillance data to prevent occupational disease and injury.

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