II. Use of Direct Surveys in the Surveillance of Occupational Illness and Injury

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Introduction

The ultimate goal of any public health endeavor is to develop and implement interventions that improve some aspect or modify some determinant of the health and well-being of a population. Successfully achieving this goal requires an accurate assessment of the current status of the problem being addressed, identification of appropriate targets for intervention, and the ability to evaluate results of interventions once they have been introduced. Surveillance plays an important role in this process.[1]

Within the context of occupational health surveillance as described in the preceding paper by Baker, Honchar, and Fine, direct surveys have become increasingly important. A direct survey is defined as the systematic collection of information (whether by questionnaire, examination, or a combination of the two) in a well-defined, firsthand manner from participants selected through a specific sampling procedure to be representative of a larger population. Although this discussion will refer in particular to large, nationwide surveys that are conducted by governmental agencies on a periodic basis, the principles transfer directly to smaller-scale efforts performed by other organizations, including private employers. Direct surveys are effective methods of obtaining surveillance data for many work-related conditions or adverse health events. This is particularly true for conditions that: produce considerable morbidity but little or no mortality (e.g., noise-induced hearing loss, occupational dermatitis, and repetitive trauma disorders); and/or may not be easily recognized as work-related or unambiguously attributed to the workplace (e.g., neurotoxic disorders or non-pneumoconiotic, chronic lung disorders).

Background

In the past, direct surveys have provided useful data for surveillance of occupational illness and injury. NIOSH conducts the National Study of Coal Workers' Pneumoconiosis through the National Coal Study to monitor the incidence and prevalence of this condition among coal miners in several states.[2] Similarly, NIOSH conducted the National Occupational Hazard Survey (NOHS),[3] the National Occupational Exposure Survey (NOES),[3] and the National Occupational Health Survey of Mining (NOHSM),[4] which surveyed worksites rather than individuals to collect data for occupation- and industry-specific hazard surveillance. Finally, NIOSH researchers and others have analyzed data acquired earlier through various nationwide surveys conducted by the National Center for Health Statistics (NCHS) to provide useful information for surveillance of work-related conditions. Examples of surveys employed in this manner include the National Health Interview Survey (NHIS),[5] the National Natality Survey (NNS) (now termed the National Maternal and Infant Health Survey [NMIHS]),[6] and surveys in the National Health and Nutrition Examination Survey (NHANES) series.[7] Although data from these latter surveys have been useful for occupational health surveillance, past procedures for gathering the information were not primarily designed for this purpose.

The National Health Interview Survey (NHIS)[8] is an annual interview survey consisting of a core questionnaire that remains essentially constant from year to year and one or more supplements that are changed annually. The core questionnaire obtains demographic data and information on activity limitations; health care utilization; and the presence, severity, and impact of numerous medical conditions. Each supplement is self-contained (except for routine demographics) and is specifically designed by the sponsoring investigators to obtain detailed information about a particular condition(s) or health-related topic(s). Currently, the entire survey is administered to some 50,000 households (providing data on approximately 130,000 individuals) that are selected through a multistage, probability-sample strategy and are representative of the US civilian, noninstitutionalized population. Since 1985, versions of the survey have incorporated design features intended to facilitate future follow-up of participants and linkage with other national datasets, such as the National Death Index.[9]

The National Health and Nutrition Examination Survey (NHANES) series of nationwide surveys[10] combines questionnaire-derived data with results obtained from batteries of physical and laboratory examinations. Conducted at differing intervals since 1971, these surveys have varied in content, procedures, and methodology. NHANES surveys have examined samples of varying sizes (generally 30–40,000), and (except for one smaller survey directed at the Hispanic population) participants have been selected through methods similar to NHIS as representative of the US civilian, noninstitutionalized population. Past NHANES surveys have not had preplanned, follow-up components, although NHANES I participants were re-evaluated in the NHANES I Epidemiologic Follow-up Survey, performed approximately 10 years later. Planning for NHANES III, which began data collection in October 1988, includes provision for future follow-up on the status of study participants.

Role of Periodic Surveys in Surveillance

Large, periodic surveys offer important opportunities in occupational health surveillance, especially when this application is anticipated throughout survey planning. Although this approach may be criticized as not constituting true surveillance because some surveys are not ongoing, timely, and periodic at regular (or even irregular) intervals, or because they are expensive uses of resources, appropriate planning and careful utilization of resources can address such objections. Even when data are not directly applicable to

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surveillance needs, such surveys are valuable components of an overall, comprehensive surveillance strategy. Specifically, direct surveys can: 1) refine and standardize methodologies to be used elsewhere in obtaining surveillance data; and 2) provide normative or reference ranges for various measures of health status or adverse health effects that are monitored through other surveillance activities.[11]

Better standardization of data-collection tools is needed to improve the quality and applicability of survey results.[12] The process of standardizing methods (whether questionnaire content or examination procedures) includes ensuring that the methods produce results that are consistent, valid, and reproducible gauges of the phenomena they purport to measure. Thus, data collected via standardized methods are inherently more reliable and, all other factors being equal, should provide more accurate estimates of the parameters under investigation. Furthermore, when such standardized approaches are accepted and adopted generally, results from different studies conducted at different times and in different places can be compared meaningfully. Pooling of such standardized data offers several potential benefits, including more precise estimates, greater power to detect low-probability events or weaker associations, and more dependable evaluations of perceived trends over time. The importance of a standard questionnaire for such applications is discussed in chapter III of this monograph.

A second value of direct surveys is their ability to provide normative databases. Lack of reliable reference ranges for many parameters that are monitored in working populations is often a major impediment to research in occupational health. Whether directed toward surveillance purposes, hypothesis generation/confirmation, or targeted interventions (e.g., health hazard evaluations), such studies generally rely on detecting differential effects between exposed and nonexposed worker populations. For many reasons, obtaining a nonexposed comparison group is often difficult.[11] A suitable control group may simply be unavailable because all accessible workers are exposed to some extent to the agent of interest. When nonexposed workers are available, they may have confounding exposures to other agents that have similar effects. Furthermore, nonexposed workers may lack incentives to participate in numbers sufficient to allow valid analysis of the results. Finally, participation by both exposed and nonexposed workers in such focused studies may be subject to considerable selection bias.

Readily available and reliable reference ranges obtained via standardized procedures would help alleviate these deficiencies for both questionnaire-derived information and data obtained from procedures like spirometry or audiometry. The large number of participants in these national studies will also permit more valid compensation for the influence on the various effect estimates by confounders such as smoking, alcohol use, and the presence of other nonoccupational, medical conditions.[13] Finally, such data can also be used as reference or expected values where existing standards require specific forms of periodic testing, and they could help private industries that conduct their own routine screening or surveillance programs to monitor the health of their employees.

Normative databases will thus be available for both the general employed population and the overall adult population. Age-, sex-, and race-specific estimates will be available because of the large sample size. Some further breakdowns may also be possible, such as calculations, when appropriate, of separate reference ranges for "blue collar" and "white collar" populations. In some circumstances, reference estimates may be determined for certain broad industry or occupation categories, although the rapid decrease in cell size with such stratifications will strictly limit this type of analysis. Finally, such information may be linked with specific exposures by merging survey-derived data with a job-exposure matrix, such as that which has been constructed from data obtained in the NOHS and NOES surveys.[14] (Also, see chapter VII in this monograph.) When prevalence rates for specific diseases or conditions can be estimated from survey data, they can be compared with rates produced by other surveillance systems (e.g., workers' compensation data). This will allow better assessment of these other systems, which are subject to under-ascertainment of cases for many reasons, including failure to recognize work-relatedness and various legal or administrative (nonmedical) barriers to workers' compensation systems.

The design of these studies now incorporates improved capacity for follow-up, which offers additional benefits for surveillance activities. Given adequate resources, repeated assessment of the entire survey cohort (or a representative subsample) will identify trends in prevalence rates over time and allow calculation of more precise incidence rates. It will also help to identify the characteristics that best serve as predictors of future disease (i.e., identify high-risk populations in greatest need of direct interventions). Specific subpopulations of survey participants can also be selected for follow-up. Individuals known to have conditions of interest can be resurveyed to improve understanding of the progression and natural history of these conditions and of their consequences (e.g., social and economic). Analyses can also be performed to compare the course of disease among exposed and nonexposed participants.

Specific Future Plans

To improve the value of direct national surveys for occupational health surveillance, NIOSH and NCHS have collaborated to include occupational health sections in the 1988 NHIS survey and as components of the current NHANES III survey.[15] The conditions proposed for inclusion in these surveys were selected using several criteria:

- The conditions were to be relatively frequent so that a sufficient number of cases for meaningful analysis could be expected in the survey population.
- A relatively high risk-percentage of these conditions should be attributable to the workplace. In general, the conditions were selected from the NIOSH list of 10 leading work-related diseases and injuries.[16]
- The target conditions were to be relatively amenable to currently available preventive strategies.
- For NHIS, the conditions must be able to be reliably diagnosed by reporting of symptoms and/or by other questionnaire-derived information. For NHANES, the conditions must be diagnosable through a combination of questionnaire-derived information and data obtained from relatively simple and readily available examination procedures (which are suitable for field use).

The 1988 NHIS included an Occupational Health Supplement with sections that provide detailed investigation of occupational history (current and longest-held jobs); back pain; hand discomfort (related to repetitive trauma disorders like carpal tunnel syndrome); work-related acute injuries;

occupational dermatitis; mucosal irritations of the eye, nose, and throat; and a final section (designed in collaboration with the Bureau of Labor Statistics) briefly investigating the presence and consequences of several potentially work-related conditions, such as tendonitis, hepatitis, and chronic bronchitis.* NHANES III, which began field operations in October 1988, includes a questionnaire section on occupational history (current and longest-held jobs) and questionnaire/examination modules that address respiratory conditions and work-related neurotoxicity. Additional data will be obtained on a variety of biologic exposure markers and biochemical measures of health status. On completion, both surveys are expected to provide valuable data that are directly and indirectly applicable to the surveillance of occupational illness and injury.

Conclusions

Direct surveys provide important opportunities to obtain health information on individuals that cannot be collected in other ways. Surveys are particularly useful in ascertaining the prevalence of conditions that manifest as morbidity rather than mortality and that can be detected by survey questionnaire or diagnostic tests. Large national surveys provide further opportunities to standardize methods to be used in smaller surveillance projects directed at defined exposed populations and to create reference values for comparison with the results of these smaller studies.

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*Questionnaire content is available from the author or from NCHS.

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1. Lenore S. Azaroff, Charles Levenstein, David H. Wegman. 2002. Occupational Injury and Illness Surveillance: Conceptual Filters Explain Underreporting. *American Journal of Public Health* **92**:9, 1421-1429. [Abstract] [Full Text] [PDF] [PDF Plus]