The Role of the States in a Nationwide, Comprehensive Surveillance System for Work-Related Diseases, Injuries, and Hazards

A Report from the

NIOSH-CSTE Surveillance Planning Work Group

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Table of Contents

Executive Summary

Surveillance is vital to the prevention of occupational diseases, injuries, and fatalities. It provides information necessary to document the magnitude of workplace health and safety problems, to set research priorities, and to target and evaluate interventions to improve worker safety and health. While there have been substantial improvements in surveillance of occupational diseases and injuries in the United States over the last decade, surveillance remains inadequate. There is no comprehensive, nationwide system of surveillance for occupational diseases, injuries and hazards. Current surveillance activities are fragmented, and there are significant surveillance gaps. Recognizing that States play an important and unique role in surveillance, NIOSH has provided financial support and technical assistance to State agencies since the early 1980's to assist in establishing and enhancing their occupational health and safety surveillance programs. Improved planning and coordination of surveillance activities is essential to more effectively use limited occupational safety and health resources.

In 1998, NIOSH embarked on a process to assess current surveillance needs and to identify goals for the next decade. The Council of State and Territorial Epidemiologists, with support from NISOH, established a Surveillance Planning Work Group to provide state input to this strategic planning process. Work Group findings and recommendations are summarized in this report.

Role of the States in the Surveillance of Work-Related Diseases, Injuries, and Hazards

State health agencies that have access to a wide variety of public health data systems and are recognized as a central force in public health have a critical and complementary role to play in surveillance of occupational diseases, injuries and hazards. They are in a unique position to:

Provide critically needed data on occupational diseases.
Generate information necessary to evaluate the conventional occupational injury data sources.
Actively link surveillance findings with intervention efforts at the State and local levels.
Integrate occupational health into mainstream public health practice.

Vision of State-Based Occupational Health Surveillance

A comprehensive nationwide surveillance system for occupational diseases, injuries and hazards is a conceptual framework that incorporates and coordinates existing and new surveillance systems for occupational health conditions and their determinants at the federal, state and local levels. The system is constructed to take advantage of existing data systems where possible, while building new data systems to fill identified gaps

In a comprehensive system, all States will have the capacity to conduct surveillance of occupational injuries, diseases, and hazards. At a minimum, this capacity will include personnel and resources to carry out surveillance of occupational health indicators using existing data systems, and develop working relationships with federal, state and local partners in both the

public and private sectors. States will also conduct in-depth surveillance, follow-up, and intervention for specific, targeted diseases, injuries and/or hazards. Targeted conditions will vary from state to state.

Perspectives on Resource Allocation for State-Based Occupational Disease, Injury and Hazard Surveillance

The ongoing CSTE Occupational Health Surveillance Work Group identified the following priority areas for allocation of federal resources for state-based surveillance in the future refers to the following three points/subheads.

Core Occupational Health Programs

Within this category, states would have an opportunity to compete for funds to support core occupational health programs, which include essential functions of surveillance, intervention and policy development. Ideally, in the long run, funding for core occupational health programs would be available to all states.

Capacity-building for States without occupational health programs

In this category, resources would be made available states without occupational surveillance programs to build their capacities to conduct occupational health surveillance. It is important to reserve capacity building resources for "new" states, because states without established surveillance programs find it difficult to compete with other experienced states for funds.

2. Condition-Specific In-depth Surveillance and Intervention

Within this overall category, state occupational surveillance programs would have an opportunity to compete for resources to pilot and implement surveillance and intervention programs for targeted diseases, injuries, or hazards. Priority conditions for targeted, in-depth surveillance would be identified periodically through a collaborative process involving NIOSH, states and other partners. Funds would be allocated within the context of the comprehensive surveillance plan that includes, for example, criteria for geographic distribution and industrial mix in the consideration of awards. There is consensus that funding should be provided to all interested states to conduct surveillance of elevated blood lead levels in adults using the ABLES model.

3. Emerging Issue Projects

NIOSH would reserve a proportion of the available surveillance resources to address new and emerging problems. This could include projects addressing new diseases or new causes of previously recognized diseases or injuries. Candidate problems/projects would be identified by a jointly by NIOSH and the states.

Priority Conditions for Surveillance in a Comprehensive Nationwide Occupational Health Surveillance System

Following the approach used previously by CSTE in planning surveillance in other public health domains, Work Group members identified priority occupational health conditions to be placed under surveillance. For each priority condition, a profile including a surveillance case defintion and goals for surveillance was developed. The list of priority conditions is as follows:

-Work-related asthma
- Occupational Cancers
- Elevated blood and urine levels of arsenic, cadmium and mercury
- Noise-induced hearing loss
- Occupational pesticide-related illnesses and injuries
- Fatal occupational injuries
- Work-related cardiovascular disease
- Pneumoconioses
- Elevated blood lead levels in adults
- Work-related musculoskeletal disorders of the upper extremities and low back
- Occupational skin diseases
- Occupational exposure to blood-borne pathogens
-Non-fatal occupational injuries

Cross-Cutting Issues and Recommendations

The Work Group also identified a number of surveillance issues that cut across the priority health conditions. These issues and recommended solutions are summarized below. They are divided into short-term and longer-term priorities.

Short-term priorities

Issue - Technical advisors for priority conditions under surveillance:
Recommendation: NIOSH should designate individuals who have, as a significant part of their regular duties a lead technical advisory role for each specific condition under surveillance.

Issue - Technical assistance to States:

Recommendation: NIOSH should develop and support effective mechanisms for providing technical assistance to States for occupational health surveillance core capacity building.

Issue - Integrating occupational health into mainstream public health:

Recommendation: NIOSH support for core capacity building should require collaboration with environmental, injury prevention, maternal and child health, and other relevant public health programs at both the federal and State levels.

Issue - Links between surveillance and research/intervention:

Recommendation: Surveillance findings should be better used to identify research and intervention priorities within NIOSH and within the NORA priority areas.

Issue - Coordination among federal agencies:

Recommendation: There should be increased collaboration among federal agencies involved in surveillance including NIOSH, MSHA, OSHA, BLS, EPA, NCHS, and other institutes within CDC. An ongoing working group of the key agencies should be established to coordinate surveillance activities among agencies and resolve interagency issues.

Issue - CDC surveillance coordination:

Recommendation: NIOSH should work with other federal partners to develop and enhance a public health surveillance system for occupational injuries, diseases, and hazards which has data elements that are defined, collected, maintained, and transmitted in identical ways.

Issue - Occupational Health Information Systems

Recommendation: NIOSH should take an active leadership role in encouraging the inclusion of industry and occupation information in federal and State health, vital record, and census data systems

Issue - Surveillance Research Methods:

Recommendation: NIOSH and CDC should provide support and technical assistance to states in developing sound approaches to surveillance system evaluation.

Long-Term Priorities

Issue - State-specific analysis of national data sets:

Recommendation: NIOSH should conduct analyses of national data systems to produce surveillance data that are useful for States and collaborate with States in developing State profiles.

Issue - Coordination of NIOSH-funded activities at the State level:

Recommendation : To the extent possible, NIOSH-funded research and training awardees should be encouraged — as part of their requirements under contracts, cooperative agreements, and grants — to collaborate with State agencies conducting surveillance and intervention, particularly when research and surveillance are conducted in related topical areas.

Issue - Special populations at risk:

Recommendation: At both the State and Federal levels, occupational safety and health surveillance systems should be developed and surveillance data should be analyzed to document the magnitude, distribution, and trends of workplace injury, disease and mortality among special populations of at-risk workers.

Issue - Occupational health indicators for local public health planning:

Recommendation: To the extent feasible, occupational health surveillance data should be collected in such a way that it is available for local level assessment efforts.

Issue - Employment data:
Recommendation: NIOSH should work with the Bureau of Labor Statistics and other relevant partners to systematically identify and provide accessible information about alternative sources of state and local level employment data and the strengths and weaknesses of these data sources.

Issue - Rapid response to emerging problems:
Recommendation: NIOSH and States should collaborate to develop a formalized plan to rapidly implement surveillance systems for emerging problems and also to coordinate and optimize rapid responses to emerging problems identified at the Federal and/or the State level.

Preface

This document contains the recommendations of the NIOSH-CSTE Surveillance Planning Work Group. This Work Group was established during the summer of 1998 to make recommendations to NIOSH concerning State-based surveillance activities for the next decade. There were three events that led to the creation of the Group. First, NIOSH included development of a surveillance system for major occupational diseases, injuries and hazards as one of the agency's four goals in its strategic plan for 1997-2002 prepared in response to the Government Performance and Results Act (GPRA). This plan included a specific 1999 objective — to undertake a comprehensive surveillance planning process with NIOSH partners at the State and Federal levels to establish surveillance priorities and define roles for various agencies.[1] Second, the States presented their perspectives on State-based occupational safety and health surveillance activities at the meeting of the NIOSH Board of Scientific Counselors in February1998. The unique role, contributions, and needs of State agencies in conducting occupational safety and health surveillance were discussed. Third, in response to State concerns voiced at the February meeting, representatives of NIOSH and selected States met in April 1998 to discuss surveillance issues and future directions. NIOSH committed to actively include State representatives as part of the NIOSH surveillance planning process and to establish a NIOSH-States Work Group for surveillance planning.

The States needed a formal mechanism for collectively providing input to NIOSH. This issue was discussed at the annual SENSOR-ABLES meeting in June 1998. The general sense of that meeting was to work through the Environmental-Occupational-Injury Committee of the Council of State and Territorial Epidemiologists (CSTE). With the help of CSTE, ten volunteers from the States were recruited to participate in the Surveillance Planning Work Group, which came to be known as the NIOSH-CSTE Surveillance Planning Work Group. The State participants included individuals from geographically diverse States with surveillance programs in different stages of development. States with and without NIOSH surveillance funding were represented. The nine NIOSH members of the Work Group included individuals from each of the NIOSH Divisions, as well as the NIOSH Surveillance Coordinating Group. A member of CSTE staff also participated. From September 1998 through February 1999, the Work Group held two working meetings, had several conference calls, and completed a variety of assignments and writing tasks to prepare this planning document.

The Work Group acknowledges the contributions of the technical reviewers who provided comments on condition-specific profiles included in this report and of the many individuals within NIOSH and in the States who commented on the draft document. These individuals are acknowledged by name in Appendix 1. Thanks are also extended to Geneva Cashaw, Lyn Bell, Sally Brown, and Shantel Brown at NIOSH and to Kathy Getz and other staff of CSTE who assisted with organizing the Work Group meetings and preparing this report.

This planning process provided a rare and rewarding opportunity for Work Group members to take a step back from day to day surveillance and research activities and reflect on the long range occupational health and safety surveillance needs of the States and the nation. Work Group members worked with a tremendous spirit of collegiality and a shared commitment to surveillance as an essential component in the overall effort to prevent work-related illness, injury and death.

An initial draft of this report was submitted to NIOSH in June, 1999 and contributed substantially to the *NIOSH Surveillance Strategic Plan* published in August 2000.[2] This report was updated and finalized for publication by the CSTE in July 2001.

I. Introduction

Surveillance is vital to the prevention of occupational diseases, injuries, and fatalities.[3] It provides information necessary to draw attention to the magnitude of workplace health and safety problems, to set research priorities, and to target and evaluate interventions to improve worker safety and health. While there have been substantial improvements in surveillance of occupational diseases and injuries in the United States over the last decade, surveillance remains inadequate. There is no comprehensive, nationwide system of surveillance for occupational diseases, injuries and hazards. Current surveillance activities are fragmented, and there are significant surveillance gaps. Recognizing that States play an important and unique role in surveillance, NIOSH has provided financial support and technical assistance to State agencies since the early 1980's to assist in establishing and enhancing their occupational health and safety surveillance programs. Examples of current State-based surveillance programs sponsored by NIOSH include the Sentinel Event Notification Systems for Occupational Risks (SENSOR), the Adult Blood Lead Epidemiology and Surveillance System (ABLES), and the Fatality Assessment and Control Evaluation (FACE) program. (See Appendix 2). These limited State-based surveillance activities are neither nationwide in scope nor involve a full spectrum of priority conditions for surveillance. The existing State surveillance systems, which are largely federally funded, tend to reflect federal priorities and do not necessarily reflect the priorities of the States. Improved priority setting and coordination of surveillance efforts is essential to more effectively use limited occupational safety and health resources currently allocated to surveillance and to enhance opportunities for obtaining additional resources in the future.

The NIOSH-CSTE Surveillance Planning Work Group established to make recommendations to NIOSH concerning State-based surveillance activities for the next decade. Early in the process, Work Group members agreed that the surveillance planning process should be outcome driven, i.e., begin with the identification of occupational diseases, injuries, exposures and hazards to be placed under surveillance. The ongoing efforts of the Council of State and Territorial Epidemiologists (CSTE) to develop an over-arching system for all public health surveillance activities provided an important framework for the Work Group planning activities. CSTE, in consultation with CDC, has traditionally determined the list of infectious diseases and other conditions, including some injuries and environmental exposures, to be placed under nationwide surveillance. In December 1994, CSTE called for the creation of a National Public Health Surveillance System (NPHSS) to expand, coordinate, prioritize and standardize approaches to public health surveillance nationally and across disciplines, e.g., communicable disease, injury control, chronic disease, and occupational health. To establish the NPHSS, CSTE issued a call to public health epidemiologists in different fields to identify which conditions (e.g., health events and determinants) should be placed under surveillance and how surveillance should be carried out.[4] The Work Group, therefore, embarked on a process that would provide input to NIOSH and, at the same time, generate a set of profiles on priority occupational illnesses, injuries, and hazards that would eventually be recommended by CSTE for inclusion in the NPHSS.

In addition, the Work Group discussed short-term and long-range visions for State-based surveillance activities and various approaches for allocating limited NIOSH funds to the States. Work Group members also identified a number of surveillance issues that cut across specific conditions and have included recommendations to address these issues in the report. While NIOSH members participated fully in all discussions and development of the profiles on proposed priority conditions, comments in this document regarding funding and recommendations to address crosscutting issues are solely attributable to the State members of the Work Group.

This document should be seen as a work in progress. The profiles for priority conditions to be placed

under surveillance are in draft form and are subject to further input from public and private partners and to editing for consistency of content and format. As of May 2001, an ongoing CSTE Occupational Health Surveillance Work Group is in the process of defining specific measures - occupational health indicators - for these priority conditions that should be placed under surveillance in all States. (See Box on this page.)The Work Group anticipates that the list of priority conditions and specific occupational health indicators will evolve over time. Surveillance methods will likewise change as changes in the health care delivery system and information technology provide new opportunities for data collection.

Surveillance indicator: *A surveillance indicator is a construct of public health surveillance that defines a specific measure of the health (i.e., the occurrence of a disease or other health-related event) or a factor associated with health (i.e., health status or other risk factor) among a specified population. Surveillance indicators bring consistency to comparisons between different populations. It should be clarified that CSTE action placing an indicator under national public health surveillance is advisory to the States. It represents a professional consensus that the indicator is important, and that meaningful data can be collected at the State level. Implementation is necessarily dependent upon availability of fiscal resources, and epidemiological capacity, as well as State priorities.*

II. The Role of the States in the Surveillance of Work-Related Diseases, Injuries, and Hazards

State health agencies, which are vested with legal authority to require disease reporting and collect other health data, play a central role in public health surveillance. Whereas public health surveillance was once focused on infectious disease, it has expanded in recent years to include surveillance of the full range of health outcomes and their determinants, e.g. chronic diseases, injuries, and health behaviors.[5] In the domain of occupational safety and health, however, national statistics on occupational injuries and illnesses have been generated largely outside of the public health infrastructure and rely heavily on data reported by employers. State health agencies, which have access to a wide variety of public health data systems and are recognized as a central force in public health have a critical and complementary role to play in surveillance of occupational diseases, injuries and hazards.[i,5] They are in a unique position to:

Provide critically needed data on occupational diseases.
It is well recognized that the most widely used occupational health data sources, namely OSHA logs and workers' compensation records, substantially undercount occupational diseases. State agencies, which have legal authority to require disease reporting, can access or augment existing health data systems to fill this information gap. As shown in Table 1, a variety of public health data sources are being used by State agencies to document work-related diseases. Additionally, occupational disease surveillance is contingent upon physician recognition that disease is work-related. State-based surveillance systems and physician reporting requirements provide important vehicles for physician education.

Generate information necessary to evaluate the conventional occupational injury data sources.
Both the Annual Survey of Occupational Injuries and Illnesses and the recent OSHA Data Initiative are based on employer reports of occupational injuries and illnesses. There has been long standing concern over the accuracy of records maintained by employers.[6] Increased reliance on these data to target regulatory activities has prompted greater concern about their adequacy and underscored the need for evaluation. Do OSHA logs undercount occupational injuries? Do the official estimates systematically undercount certain types of workplaces or certain populations of workers? Similar questions can be asked about who does and who does not get counted in State workers' compensation statistics. Because State surveillance programs generally use multiple data sources to document health outcomes, these data can be used to provide answers to these questions. The answers are important in targeting interventions and in better understanding the full economic and human burden of occupational diseases and injuries.

Actively link surveillance findings with intervention efforts at the State and local levels.
Surveillance findings, to be meaningful, must be actively linked to intervention and prevention efforts. Intervention is, in large measure, local. It involves interacting with individuals, establishments, and organizations in the community. State agencies have in-house intervention resources and maintain day-to-day working relationships with a wide range of potential "interventionists" — at both the State and community levels — who can use surveillance data to take action, quickly and directly. These range from State and Federal OSHA staff, and occupational

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i *Jurisdiction for data collection and surveillance will typically overlap between State agencies and interagency collaboration is necessary. The lead occupational health surveillance agencies in States will vary depending upon the state infrastructure. For example, in some States, Labor Departments have authority to collect physician reports of work-related diseases and injuries.*

health care providers, to school nurses and local boards of health. Colorado, for example, has used State restaurant inspectors to disseminate information about preventing work-related burns; Massachusetts works with school nurses to provide information to youth about health and safety in the workplace. A number of States work with engineering faculty at their State universities to identify and disseminate information about technological solutions to hazards identified through the FACE program. In addition, whereas national data are typically anonymous, State-based systems often identify individual workers and individual establishments and allow for individual and worksite follow-up. State health agencies may refer identified workplaces to State or Federal OSHA offices for enforcement action or conduct research-oriented investigations of workplaces, providing technical assistance to employers. They often go beyond case-by-case intervention to synthesize lessons learned across workplaces. These lessons are, in turn, translated into educational materials disseminated widely to relevant industry and labor and professional groups throughout the States. Aggregate surveillance data are likewise used to target industries, populations, and communities for educational and policy interventions.

Integrate occupational health into mainstream public health practice.
Building surveillance programs at the State level that are actively linked with intervention efforts provides an invaluable opportunity to integrate occupational health into mainstream public health. Most occupational health experts are more likely to have interfaced with OSHA and labor department staff than with public health practitioners in State health agencies. Most public health practitioners, have had very little formal training in occupational health and few links with occupational health professionals in their States. However, the public health infrastructure provides numerous opportunities, many as yet untapped, for occupational health practice. Examples range from conducting indoor air investigations in schools and development of vaccination policies for daycare workers to licensing migrant labor camps. The public health infrastructure provides a particularly important opportunity to reach special populations of workers whose needs have not been well addressed through the more conventional approaches to occupational health.

Table 1. State Data Sources Used for Occupational Health Surveillance*

Data Sources	Health Outcomes												
	Asthma	Silicosis	Teen work injuries	Amputations	Pesticide-related illness	Noise-induced hearing loss	Carbon monoxide poisoning	Dermatitis	Carpal tunnel syndrome	Hospitalized burns	Agricultural injuries	Cancers	Lead/cadmium exposures
Case Reporting Sources													
Physician reports	4	4			4	4	4	4	4		4		4
Emergency department logs					4		4				4		
Hyperbaric chamber reports							4						
Burn center reports			4										
Poison control reports					4								
News clippings										4	4		
Department of Agriculture reports					4						4		
Agriculture extension program reports					4								
Data Systems													
State hospital discharge data	4	4			4	4				4			
State outpatient surgery data									4				
Workers' compensation records	4	4	4	4		4		4	4	4			
Emergency department logs			4										
Hospital billing data			4										
HMO data systems	4												
State trauma registry			4	4									
Clinical laboratory reports													4
Death certificates		4			4						4	4	
Cancer registry data												4	

* Partial listing. For example, data sources used for surveillance of fatal occupational injuries are not included.

III. Vision of State-Based Occupational Health Surveillance

A comprehensive nationwide surveillance system for occupational diseases, injuries and hazards is a conceptual framework that incorporates and coordinates existing and new surveillance systems for occupational health conditions and their determinants at the Federal, State and local levels. The system is constructed to take advantage of existing data systems where possible, while building new data systems to fill identified gaps. Data collection and data management efforts are standardized to the extent possible to allow for linkages across systems that enable the development of a composite picture of the occupational health status of the population. The system involves collaboration and information sharing between public health and other agencies at all levels of government. It likewise involves collaboration with a wide range of private sector partners - health care professionals and providers, insurers, industry and labor - responsible for both generating health data and using surveillance findings to improve worker safety and health.

In a long range vision of a comprehensive nationwide occupational health surveillance system, State data sources are used both to augment national sources and inform national prevention priorities, and to target State and local prevention efforts. In a comprehensive system, all States will have core occupational health programs with the capacity to conduct surveillance of occupational injuries, diseases and hazards. At a minimum, this capacity will include personnel and resources to carry out surveillance of occupational health indicators using existing data systems, and to develop working relationships with Federal, State and local partners in both the public and private sectors. States would also conduct in-depth surveillance, follow-up, and intervention for specific, targeted diseases, injuries and/or hazards. In-depth surveillance provides opportunities for direct intervention and evaluation in specific workplaces. It is recognized that it is not feasible, given inevitable resource constraints, to conduct in-depth surveillance of all conditions (diseases, injuries, hazards) in all States. Federally funded support of in-depth surveillance activities at the State level would be determined within the context of the comprehensive nationwide system that takes into account existing national data systems and surveys, and surveillance priorities that have been established collaboratively by State and federal partners and their constituents. This plan would be reviewed and updated periodically. The nationwide system would be flexible enough to respond to both State and federal surveillance priorities and include the capacity to readily mount State-based surveillance of new and emerging problems.

In 1995, CSTE, working in collaboration with NIOSH, published general guidelines regarding State-based activity in occupational safety and health.[7] These guidelines identified surveillance, intervention and policy development as three essential functions of a "core occupational health program" at the State level. The level of activity (core/minimum vs. comprehensive) in each of these functional areas depends upon the stage of program development.

IV. Perspectives on Resource Allocation for State-Based Occupational Disease, Injury and Hazard Surveillance

Periodically, surveys have been performed to determine State Health Department activity in occupational health.[8,9,10] These surveys have shown that the majority of States have limited ongoing programmatic activity in occupational health. A small number of States such as California and New Jersey have active, predominantly State-funded programs; while another small group of States, such as Massachusetts, Ohio, and Texas have active programs predominantly funded through NIOSH Cooperative Agreements and grants.

The Centers for Disease Control and Prevention (CDC) provides funding for a large percentage of public health activity at the State level. A typical State health department receives over half of its public health budget from the CDC. For example, CDC provides all States with funding for surveillance of both infectious diseases, such as tuberculosis, sexually transmitted disease and AIDS, and chronic diseases. No similar nationwide CDC funding for occupational health has been provided. In the occupational health arena, the federal infrastructure consists primarily of OSHA and MSHA, the regulatory bodies; BLS, which provides employment and injury statistics; and NIOSH, a predominantly research-oriented institute. There is, in short, a "gap" in the federal infrastructure with respect to providing core support for public health practice in occupational health at the State level.

To accomplish the long range vision of a nationwide occupational health surveillance system, funds for State-based surveillance need to be significantly increased. Funding is needed by all States to support the basic infrastructure of State-based programs. The CDC budget process should include funding to support core occupational health programs in all States, similar to support CDC provides States in other public health areas. These funds would be used by States to establish and develop core occupational health programs with activity not only in surveillance but also policy development and intervention.[7] Additional funds are needed to engage a subset of States to work with NIOSH to conduct in-depth surveillance and intervention relating to specific diseases/injuries/hazards, including emerging issues. The specific States doing in-depth surveillance and the number of States would vary depending on the condition. NIOSH and States should partner with other federal agencies to identify additional sources of funding for State-based surveillance activities. NIOSH and the States also need to work closely with colleagues in other public health disciplines to assure that occupational health surveillance is integrated into an overarching public health surveillance system. NIOSH and State occupational health surveillance activities need to be coordinated with ongoing CDC/CSTE efforts to build a comprehensive, integrated, electronic public health surveillance system operational at the local, State and National levels.

In the initial June 1999 draft of this report, the Work Group recommended that NIOSH adopt a proportional allocation approach to funding State surveillance activities, and divide the pool of then currently available surveillance resources among the three categories identified below:

Capacity building, and core surveillance programs
In-depth surveillance of targeted conditions
Emerging problems

As of May 2001, NIOSH has increased funding available for ABLES and FACE programs, continued funding of a number of targeted conditions, and initiated a new program to support the development of model core occupational health surveillance programs. The ongoing CSTE Occupational Health Surveillance Work Group has identified the following priority areas for allocation of federal resources for

State-based surveillance in the future:

Core Occupational Health Programs

Within this category, States would have an opportunity to compete for funds to support core occupational health programs, which include essential functions of surveillance, intervention and policy development. Surveillance activities would include at a minimum surveillance of occupational health surveillance indicators using existing data sources (List currently under development). Ideally, in the long run, funding for core occupational health programs would be available to all States.

Capacity-building for States without occupational health programs

In this category, resources would be made available States without occupational surveillance programs to build their capacities to conduct occupational health surveillance. It is important to reserve capacity-building resources for "new" States, because States without established surveillance programs find it difficult to compete with other experienced States for funds.

Condition-Specific In-depth Surveillance and Intervention

Within this overall category, State occupational surveillance programs would have an opportunity to compete for resources to conduct and model in-depth surveillance and intervention programs for targeted diseases, injuries, or hazards. Funds could be channeled through the existing FACE, SENSOR, and ABLES programs. Priority conditions for targeted, in depth surveillance would be identified periodically through a collaborative process involving NIOSH, States and other partners. Funds would be allocated within the context of the comprehensive surveillance plan that includes, for example, criteria for geographic distribution and industrial mix in the consideration of awards. There is consensus that funding should be provided to all interested States to conduct surveillance of elevated blood lead levels in adults using the ABLES model.

Emerging Issues Projects

NIOSH would reserve a proportion of the available surveillance resources to address new and emerging problems. This could include projects addressing new diseases or new causes of previously recognized diseases or injuries. Candidate problems/projects would be identified by a panel of State and Federal representatives who meet on an annual basis.

Additional Funding Issues

Several additional funding issues were discussed by the Work Group. The possibility of regional surveillance centers located in select State agencies was considered but determined not feasible given: a) the difficulty in sharing confidential data, necessary to target local interventions, between States; and b) the limits on State employees' day-to-day involvement in activities that extend beyond the State. (At the same time, States recognized that periodic, regional meetings provide important opportunities for States to share strategies and experiences.)

The option that NIOSH impose a requirement for State matching funds in their cooperative agreements was also addressed. Some States felt that a matching requirement, or a progressive matching requirement

over time, would provide leverage to access State support for occupational health surveillance activities. Other States, in which there is less potential support for occupational health activities, felt that a matching requirement could preclude their application for NIOSH funding. This issue was not resolved. The Work Group also discussed the need to explore alternative funding mechanisms to provide continued support for targeted, condition-specific surveillance to assure continuity over time.

V. Priority Conditions for Surveillance in a Comprehensive Nationwide Occupational Health Surveillance System

Early in the planning process, the NIOSH-CSTE Surveillance Planning Work Group agreed that planning should begin with the identification of priority conditions to be placed under surveillance. Prior to the first meeting of the Work Group (August, 1998), alternative approaches to selecting and ranking priority conditions were identified through a review of the literature and discussions with CDC Centers, State Health Departments, and other non-governmental organizations. Based on these discussions, a process for selecting priority conditions was adapted from Washington State for use by the Work Group. Washington had relied heavily on a Canadian model for establishing surveillance priorities.[11]

A list of conditions identified in a prior joint meeting of State and NIOSH representatives (April, 1998) was used as the initial list of conditions. The list consisted of forty items recognized as important targets of concern (See Appendix 3). Each Work Group member was asked to review and rank each condition according to the following criteria: magnitude, severity, intervention effectiveness/preventability, emergent condition, public concern, economic impact and feasibility of surveillance. At the first Work Group meeting, rankings were summarized and discussed. Thirteen priority health conditions were identified for surveillance. The Work Group views this as an initial list that will be revised and updated based on periodic review by State, Federal and other partners. It is anticipated that priorities may change or that new problems may surface as surveillance capabilities are expanded.

The list of priority conditions includes some very specific health events, such as elevated blood lead levels in adults, as well as broadly defined conditions (non-fatal injuries and musculoskeletal disorders). Infectious diseases were also considered but not included on the list because they are already under nationwide surveillance. This is not to say that State surveillance programs for some infectious diseases would not benefit from additional attention to occupational aspects of these diseases. Occupational exposure to blood-borne pathogens is the only hazard currently on the list. The importance of hazard surveillance, in general, was well recognized and addressed, to some extent, under specific health events.

Following the approach used previously by CSTE in planning surveillance in other public health domains, Work Group members drafted profiles on each priority conditions to be placed under surveillance. Each profile includes the following sections:

Goals for Surveillance -- local, State, and National
Case Definition
Information System(s) to Collect and Aggregate Data
Partner Organizations/Other Agency Domains
Strategic Planning

For each condition, minimum and desirable surveillance activities are specified in the profile. Minimum activities are those activities that are necessary, at a minimum, to implement a nationwide occupational health surveillance system. Implementing the minimum level of activity for all of these priority conditions on a nationwide basis would for certain selected conditions require substantial resources. Desirable activities indicate directions for expanding surveillance beyond the minimal level. Recommendations for

allocating limited funds to State-based surveillance activities in the short term have been discussed previously under State Perspectives on Resource Allocation.

The proposed minimum and desirable surveillance activities for all of the priority conditions are summarized in a matrix in Appendix 4). The profiles themselves are also included in this Appendix. These profiles are in draft form and are subject to further input from public and private partners and to editing for consistency of content and format. As mentioned previously, an ongoing CSTE Occupational Health Surveillance Work Group is in the process of defining specific measures (surveillance indicators) for the priority conditions that should be placed under surveillance in all States.

For all the priority conditions, there is the need for aggregation and analysis of data on both the national and State levels and the dissemination of these data in periodic reports — analogous to the annual release of data from the BLS. It is essential that occupational illness and injury data be regularly updated and released to foster prevention activities to reduce the incidence of these conditions and improve worker safety and health.

VI. Cross-Cutting Issues and Recommendations

The Work Group identified a number of surveillance issues or concerns that cut across the priority health conditions. In the spirit of going beyond problem identification to problem resolution, concrete solutions were also discussed. These issues and recommended solutions are presented below. They are divided into short term and longer- term priorities.

Since the initial draft of this report was provided to NIOSH in June 1999, NIOSH has directly responded to a number of these concerns in the *NIOSH Surveillance Strategic Plan*.[2] The relevant *Strategic Plan* objectives are noted below where applicable.

Short-term priorities

Issue - Technical advisors for priority conditions under surveillance: A central point of contact within NIOSH does not exist to provide technical assistance and coordination of surveillance for each specific disease/injury/exposure identified as a priority surveillance indicator in this report.

Recommendation: NIOSH should designate individuals who have, as a significant part of their regular duties, a lead technical advisory role for each specific condition under surveillance. The functions of the lead technical advisors should, at minimum, include:

Conduct ongoing analyses of available national and regional data to identify national and State surveillance and prevention activities;

Facilitate standardization of data collection across States;

Produce a periodic report on the specific condition, to include available State-based data aggregated across States; and

Serve as a central clearinghouse for information on the specific condition.

These individuals should be provided adequate resources to carry out the above functions. These individuals will need to work closely with other federal agencies and State partners.

Issue - Technical assistance to States: CDC has a long history of providing technical assistance to States in developing public health surveillance/infrastructure. This has been accomplished through training programs, consultations, EPI-AIDs, assignment of employees to long-term details in the States, promotion of the EIS program, and various other exchange programs. In the occupational health arena, assignment of NIOSH staff to States has occurred rarely and only in a haphazard manner. Provision of such technical assistance is especially needed for States that have limited or no occupational health surveillance programs.

Recommendation: NIOSH should develop and support effective mechanisms for providing technical assistance to States for occupational health surveillance core capacity building, as well as for investigation and intervention activities.
[NIOSH Surveillance Strategic Plan Objective 2.2]

Issue - Integrating occupational health into mainstream public health: Although occupational health issues sometimes overlap with other public health concerns, e.g. environmental health concerns, programs within State and Federal governmental agencies do not always communicate with each other. There is no organizational infrastructure that ensures the collaboration, sharing of resources, and data to maximize the use of limited resources at the State level.

Recommendation: NIOSH support for core capacity-building should require collaboration with environmental, injury prevention, maternal and child health, and other relevant public health programs at both the federal and State levels. This collaboration should be two-way. That is, NIOSH should also encourage other federal agencies to incorporate occupational health interests into other mainstream public health programs. NIOSH should partner with other organizations such as CSTE and ASTHO to provide support/assistance to the States in establishing collaborative networks.
[NIOSH Surveillance Strategic Plan Objective 2.1]

Issue - Links between surveillance and research/intervention: To be meaningful, surveillance findings must be linked to prevention efforts ranging from worksite interventions and educational programs to regulatory activities and research. Currently the links between surveillance and both research and intervention within NIOSH are inadequate.

Recommendation: Surveillance findings should be better used to identify research and intervention priorities within NIOSH and within the NORA priority areas. Concrete mechanisms for assuring that surveillance findings are forwarded to and considered by all NIOSH Divisions and NORA teams should be established. ***[NIOSH Surveillance Strategic Plan Objective 1.2]***

Issue - Coordination among federal agencies: There is a lack of coordination at the federal level among the multiple agencies involved in surveillance of work-related diseases and injuries. There are a number of interagency issues, for example, sharing CFOI data, that need to be addressed to improve both the efficiency and efficacy of national and State occupational disease, injury, and hazard surveillance efforts.

Recommendation: There should be increased collaboration among federal agencies involved in surveillance, including NIOSH, MSHA, OSHA, BLS, EPA, NCHS, and other institutes within CDC. An ongoing working group of the key agencies should be established to coordinate surveillance activities among agencies and resolve interagency issues. ***[NIOSH Surveillance Strategic Plan***

Objective 1.1]

Issue - CDC surveillance coordination: State health departments collect public health surveillance data which are shared with a variety of different Centers of the CDC. With respect to surveillance pertaining to occupational injuries, diseases and hazards, similar or identical data may be requested by the National Institute for Occupational Safety and Health, the National Center for Injury Control, the National Center for Health Statistics, and the National Center for Chronic Disease Prevention and Health Promotion, along with other federal agencies, including the National Institutes of Health, the Agency for Toxic Substances and Disease Registry, and the Bureau of Labor Statistics. Differences in information coding and reporting create unnecessary burden on States with multiple surveillance systems and hinder their ability to efficiently collect, maintain, aggregate, and disseminate State-level data.

Recommendation: NIOSH should work with other federal partners to develop and enhance a public health surveillance system for occupational injuries, diseases, and hazards which has data elements that are defined, collected, maintained, and transmitted in identical ways. NIOSH should work with other Centers at CDC to ensure that these occupational surveillance activities are integrated as part of all public health surveillance activities at the State level. Integration and standardization are needed to reduce staffing, training, collection and analysis costs. NIOSH should continue to participate in the CDC surveillance coordination efforts and assure efforts across Centers are fused to develop a nationwide, comprehensive surveillance system for occupational injuries, illnesses, and hazards. ***[NIOSH Surveillance Strategic Plan Objectives 1.1, 1.4]***

Issue - Occupational Health Information Systems: The availability of information on industry and occupation in existing health and demographic data systems is severely limited. Many health information systems do not contain occupation and industry information; where this information is present, it is often not coded. The possibility of developing new sources of occupational health data need to be assessed in light of changes in the health care delivery system and advances in information technology. These changes provide new opportunities for efficient collection and standardization of coding occupation and industry data in health data systems.

Recommendation: NIOSH should take an active leadership role in encouraging the inclusion of industry and occupation information in federal and State health, vital record, and census data systems. This effort should specifically address electronic data-bases, especially those established in accord with the Health Insurance Portability and Accountability Act (HIPAA) electronic medical transaction standards. In addition, NIOSH should support efforts to standardize and automate the coding of industry and occupation in health and demographic information systems. NIOSH and the States need continued access to these health information systems. Finally, NIOSH needs to develop a surveillance capacity that utilizes the growing power of the worldwide web. ***[NIOSH Surveillance Strategic Plan Objectives 1.1, 1.2, 1.4]***

- **Issue - Surveillance Research Methods :** In setting the National Occupational Research Agenda (NORA), NIOSH and its partners recognized the importance of surveillance methods research to evaluate and improve existing surveillance systems and to develop new surveillance systems to fill identified gaps. Objective evaluations of existing surveillance systems are needed to maximize the validity and utility of information, yet few resources are available to the States for surveillance system evaluation. There are also numerous potential sources of occupational disease and injury data within States that have not been fully explored nor utilized. The use of nontraditional data sources and

linkages of data systems are virtually unexplored.

Recommendation: NIOSH and CDC should provide support and technical assistance to States in developing sound approaches to surveillance system evaluation. NIOSH should also encourage and support the development of methods for the utilization and modification of different existing data systems (trauma registries, hospital discharge data, emergency department records, private health insurers, and existing health or behavior surveys) at the State level, including evaluation of these existing data systems (capture, data quality, richness of data, and resource requirements) for providing State-specific information to set prevention priorities. In 2000, NIOSH awarded funding to support surveillance research efforts in several States. These awards were important steps towards this end. ***[NIOSH Surveillance Strategic Plan Objectives 5.1, 5.2, 5.3]***

Long-Term Priorities

Issue - State-specific analysis of national data sets: States do not necessarily have the expertise to analyze available national data sets. National data systems can provide important information for targeting surveillance and intervention efforts at the State level. These systems include for example, NSSPM, NHIS, NHANES, CFOI, Annual Survey of Occupational Injuries and Illnesses, BRFSS, IMIS, and NEISS.

Recommendation: NIOSH should conduct analyses of national data systems to produce surveillance data that are useful for States and collaborate with States in developing State profiles. Specifically, where the national data systems allow State level analyses, these data should be used to generate State specific findings which are made available to the States and used in the development of the State profiles. These findings should be accompanied by guidance on utilization of data for developing State intervention activities. ***[NIOSH Surveillance Strategic Plan Objective 2.1]***

Issue - Coordination of NIOSH-funded activities at the State level: There is a lack of coordination between NIOSH funded research and training activities in the States and NIOSH supported surveillance activities in the States - even when these address the same topical areas. As a result, there are many missed opportunities for collaboration and maximizing use of limited resources.

Recommendation: To the extent possible, NIOSH-funded research and training awardees should be encouraged — as part of their requirements under contracts, cooperative agreements, and grants — to collaborate with State agencies conducting surveillance and intervention, particularly when research and surveillance are conducted in related topical areas. For example, ERCs should be required to establish training opportunities for their students within State health departments. In turn, State-funded surveillance programs should be required to offer meaningful training opportunities to ERC students. As appropriate, evidence of collaboration should be included among the criteria used to evaluate research/training funding applications. Increased efforts to systematically inform researchers/surveyors of NIOSH-funded activities in their geographical areas should be undertaken.

Issue - Special populations at risk: Certain populations of workers are more likely to experience increased risks of diseases and injuries in the workplace as a direct or indirect result of biologic, social, and/or economic characteristics such as age, race, genetic susceptibility, disability, language, literacy, culture, and low income. Essential occupational health surveillance and employment data on special populations of workers, for example, workers of color and low income workers, are limited. It is not known whether and to what extent groups of underserved workers are systematically undercounted in existing occupational health data systems such as the Annual Survey of Occupational

Injuries and Illnesses and workers' compensation record systems.

Recommendation: At both the State and Federal levels, occupational safety and health surveillance systems should be developed and surveillance data should be analyzed to document the magnitude, distribution, and trends of workplace injury, disease and mortality among special populations of at-risk workers. These findings should be effectively disseminated so that resources for prevention can be appropriately targeted. In addition, major occupational health surveillance systems at both the State and Federal levels should be evaluated to assess possible systematic undercounting of special populations in these major health data systems. ***[NIOSH Surveillance Strategic Plan Objective 3.5]***

Issue - Occupational health indicators for local public health planning: There is an increasing reliance on community data and health status indicators for use in local priority setting and community health planning. Whereas a great deal of State public health data is now available for localities (e.g., birth rates, death rates, cancer rates), local data on occupational health outcomes are not typically available. Local occupational health issues can be misrepresented by the use of State-level data and information, and as a result, occupational health often gets left out of community-level public health assessment and planning activities.

Recommendation: To the extent feasible, occupational health surveillance data should be collected in such a way that it is available for local level assessment efforts. These data should, in turn, be made readily accessible for such community assessment initiatives, and guidance regarding use of the information should be integrated into ongoing health department efforts to facilitate effective use of health data for community public health planning. ***[NIOSH Surveillance Strategic Plan Objective 2.1]***

Issue - Employment data: Employment data that can be used to compute industry-specific occupational injury and acute illness rates at the State and local levels are limited. There are a variety of different sources of employment data, for example, the decennial US Census, the Current Population Survey, and State unemployment data systems, each with its own strengths and weaknesses, and there is no standard method nor set of methods for using these data to compute estimates of risk.

Recommendation: NIOSH should work with the Bureau of Labor Statistics and other relevant partners to systematically identify and provide accessible information about alternative sources of State and local level employment data and the strengths and weaknesses of these data sources. These entities should work with the States in developing standard methods for using these data to generate estimates of risk and provide guidance to the States in using these methods. New data collection efforts to augment the limited employment data currently available should be considered.

Issue - Rapid response to emerging problems: There are two separate issues with respect to emerging problems to be addressed. The first is developing surveillance systems for emerging occupational health and safety problems such as latex allergies. The second is developing rapid response to emerging problems identified through existing surveillance systems. The States generally have more flexibility in initiating rapid response than NIOSH. NIOSH has programs set up to respond to requests (i.e., the HHE program), but these responses tend to be reactive rather than based on systematic evaluation of the data. States should be using their data to identify emerging problems and should have the mechanism to respond in place.

Recommendation: NIOSH and States should collaborate to develop a formalized plan to rapidly implement surveillance systems for emerging problems and also to coordinate and optimize rapid responses to emerging problems identified at the Federal and/or the State level. ***[NIOSH Surveillance Strategic Plan Objective 2.2]***

VII. Next Steps

The high toll of work injuries and illnesses is not unchangeable.[3] Significant progress has been made in improving worker health and safety since the passage of the Occupational Safety and Health Act in 1970, but much remains to be done to address long-standing problems and new challenges associated with a changing U.S. workplace. Development of a comprehensive, nationwide occupational health surveillance system is central to the overall prevention strategy and to measure progress towards the Healthy People 2010 Objectives.[12] The States have a critical role to play in this comprehensive surveillance system. States agencies are at the front lines in both collecting data and using surveillance findings to take direct action to protect worker safety and health. States can provide data to augment national data sources and help set national prevention priorities. State data are also essential to target and evaluate prevention efforts at the State and local levels. In the long range vision of a comprehensive nationwide occupational health surveillance system, all States will have core capacity to conduct surveillance of occupational injuries, disease and hazards, and select States will conduct in-depth surveillance and follow-up of priority conditions. Priorities will be established jointly by NIOSH, the States and their public and private sector partners. This nationwide system requires a sustained federal commitment to provide funding and technical assistance to the States. The State agencies are fully committed to working with NIOSH toward these ends.

The surveillance strategic planning process has been a significant step forward. *The NIOSH Surveillance Strategic Plan*, together with this report, will guide NIOSH and the States to make better use of existing resources allocated to occupational health surveillance and enhance opportunities to garner additional resources for surveillance in the future. The continued State-federal collaboration will optimize our ability to use the powerful tool of surveillance to safeguard the health and safety of the nation's workforce. Towards this end, the following next steps should be undertaken:

The CSTE Occupational Health Surveillance Work Group should be continued to provide a formal vehicle for ongoing input to NIOSH from the States. The Work Group should also take the lead in the development of specific occupational health indicators to be placed under surveillance in all States.

The CSTE Occupational Health Surveillance Work Group and the NIOSH Surveillance Coordinating Group should meet together periodically to assure that State and federal perspectives on surveillance activities are successfully merged.

NIOSH should appoint an individual from a State health agency to serve on the NIOSH Board of Scientific Councilors to enhance communications between NIOSH and the States.

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Appendices

Appendix 1. List of Technical Reviewers and Those Who Provided Comments on the Draft

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Appendix 2. Description of State-based Surveillance Activities Funded by NIOSH as of 1999.

Adult Blood Lead Epidemiology and Surveillance (ABLES) Program
ABLES is a State-based surveillance system for identifying cases of elevated blood lead levels among adults living in the United States. The surveillance of elevated blood lead levels provides the public health community at local, State, and Federal levels with essential data for monitoring adult lead poisoning and for setting priorities for research, intervention, and education. Cases identified through ABLES are used by States to identify and target high risk industries and occupations, conduct follow-ups with physicians, conduct on-site inspections of work sites, and conduct hazard surveillance to identify exposure problems and solutions. Findings from ABLES data have been used to identify hazardous occupational exposures to lead in radiator repair shops, battery recycling operations, bridge repair, home remodeling, and residential painting. Cases are used by State and Federal OSHA programs for referrals for consultation and enforcement. Results from the ABLES program are published periodically in the CDC's Morbidity and Mortality Weekly Report. The ABLES program is a State-based system which is conducted in collaboration among various NIOSH Divisions, other CDC Centers (National Center for Environmental Health, National Center for Health Statistics), federal agencies (OSHA, HUD), non-profit associations (Council of State and Territorial Epidemiologists, Center for Protection of Worker Rights). In 1999, 27 State programs collected and analyzed blood lead level data from local health departments, private health care providers, and private and State reporting laboratories. States which received NIOSH funding to support ABLES activities in 1998 included Alabama, Arizona, Connecticut, Iowa, Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, Texas, Washington, Wisconsin, and Wyoming. The total amount of NIOSH funding provided to these States for the ABLES Program in 1999 is $449,038.

State-Based Fatality Assessment and Control Evaluation (FACE) Program
The State-based Face Program involves case identification of fatal occupational injuries and investigation of selected cause-specific fatalities. The objectives of this program include the identification of work environments which place workers at high risk for fatal injury, the characterization of potential risk factors, the development of appropriate prevention strategies and the dissemination of information pertaining to such strategies. State-base activities include the active surveillance of all external causes of occupational deaths and in-depth field investigations are conducted on selected fatal injuries which are determined by regional and national priorities. On-site investigations involve the use of a standard protocol and data collection instruments to collect detailed epidemiologic information pertaining to the circumstances, characteristics, and risk factors. Agent, victim, and environmental data are evaluated in relation to present, event, and post-event phases of the incident. The ability to combine case identification descriptions with information from on-site investigations results in data more detailed than that normally produced by other surveillance systems. States which received NIOSH funding for State-based FACE Programs in 1998 included Alaska, California, Iowa, Kentucky, Massachusetts, Minnesota, Missouri, Nebraska, New Jersey, Ohio, Oklahoma, Texas, Washington, West Virginia, and Wisconsin. The total amount of funding provided to these States for their FACE Programs in 1999 is $1,352,901.

Sentinel Event Notification Systems for Occupational Risks (SENSOR) Program
SENSOR is NIOSH program with State health departments, or other State agencies in collaboration with State health departments, to develop generalizable, condition-specific strategies for State-based surveillance of selected occupational diseases and injuries. Each surveillance system is linked to one or

more prevention-oriented interventions, including educational, consultative, research, regulatory, and/or enforcement activities. SENSOR activities are relevant to Healthy People 2010 draft objectives pertaining to reducing work-related injuries, reducing cases of work-related hearing loss, reducing occupational skin disorders, and improving workplace injury and illness surveillance. Information pertaining to selected cases and recommended prevention strategies is of interest and utility to EPA, OSHA, and MSHA. Specific efforts in State-based activities include standardization of variables collected by State programs, enhancement of software to facilitate data collection, coding, and reporting, data compilation across States to facilitate aggregate analyses, comparison of SENSOR findings to other surveillance data, and further development of State-based prevention activities to surveillance. In 1999, 13 States are funded by NIOSH to develop or field test surveillance strategies for nine target conditions: amputations (Minnesota), work-related asthma (California, Massachusetts, and Michigan), burns (Kentucky, Utah), carpal tunnel syndrome (California), dermatitis (Oregon, Washington), silicosis (New Jersey, Ohio), youth injury/illness (Massachusetts) and acute pesticide health effects (California, Florida, New York, Oregon, and Texas) with EPA-support for follow-back case evaluations (California, New York, and Texas). The total amount of funding provided to these States for their SENSOR Programs in 1999 is $2,135,447.

Appendix 3. Detailed Chronology of the Planning Process and Ranking Exercise

NIOSH State Workgroup

At the first meeting (September 23-24, 1998), primary authors were assigned to draft 13 condition-specific surveillance profiles. These occupational conditions included asthma, blood borne pathogen exposures, cancer, cardiovascular disease, dermatitis, fatal injuries, hearing loss, lead, other heavy metals (arsenic, cadmium, and mercury), musculoskeletal, pesticide poisoning, pneumoconiosis, and serious nonfatal injuries. After review and discussion of these profiles at the second meeting (November 3-4, 1998), the primary authors were asked to obtain a review of their profile from subject matter technical experts. These comments and feedback were used by the primary profile authors to revise the draft profiles, which were submitted to the Surveillance Coordination Activity (SCA) for compilation and review for consistency (Mid-January, 1999).

At the beginning of the surveillance planning activity, a Second Tier of relevant reviewers were also identified. The Second Tier consisted of Principal Investigators of the ABLES, SENSOR, and FACE programs along with 18 additional representatives (9 from NIOSH and 9 from the States). These individuals expressed interest in being involved in the planning process but many were not present at the September and November Workgroup Meetings due to resource limitations. The Second Tier of reviewers reviewed and commented on the preliminary draft of the Workgroup Report. Concurrently, the NIOSH Surveillance Coordination Group (SCG) received the Draft version of the Workgroup Report for review and comment. The draft material developed by the joint NIOSH-STATE Workgroup was considered by NIOSH in developing Surveillance Strategic Plan for the year 2010.

Key Surveillance Indicators Identified at the April 1998 NIOSH and States Meeting
(In order mentioned and not by priority)

- lead
- heavy metals
- asthma
- carpal tunnel syndrome
- pneumonconiosis
- radon
- noise-induced hearing loss
- carbon monoxide
- diesel
- cancer
- fatal injury
- teenage injury
- burns
- severe nonfatal injury

  silicosis
  pesticides
  back injuries
  amputations
  heart disease
- IMIS-MSHA citations > PEL
- bladder cancer
- musculoskeletal (upper extremity)
- fractures
- adverse pregnancy outcomes
- motor vehicle accidents
- head trauma
- hearing protection
- central nervous system disorders
- chemical releases (TRI)
- hepatitis
- eye injuries
- indoor air quality investigations
- energy sources
- dermatitis
- tuberculosis
- asbestosis
- stress
- infectious diseases
- machine guards
- respirator use
- assault/violence
- drownings
- kidney disease
- emergency medical service runs

Selecting Priority Health Outcomes for Surveillance

Criteria used to rank health outcomes

- **Magnitude of the problem: Incidence/prevalence** - How common is the condition in the workforce or retired workforce?

  Severity: Morbidity - How severe is the condition(e.g. acute illness, hospitalizations (number and length) disability, sequelae.

  Severity: Mortality - Consider how many deaths are attributable to the condition and the proportion of person with the condition who die (case fatality rate). It is not entirely clear what to do where a condition has low overall mortality, but a high case fatality rate. e.g., rabies. Use your judgment as to what is important.

  Preventability/treatability - What level of efficacy can be attained through prevention measures? Is the condition treatable?

  What is the necessity for immediate public health response - How important is it for health officials to act immediately upon learning of case in order to prevent further impact?

  Policy/regulatory action - Is this condition current being debated in the policy arena? Would the surveillance information have important use in shaping public health or regulatory policy?

  Economic impact - consider the cost of the occurrence of the condition, such as medical care, respite care, support of long-term sequelae and lost productivity

- **Emergent condition**: To what extent is this condition newly recognized or likely to increase dramatically?

Appendix 4.

Table 2. Matrix of Priority Conditions to be Placed under Surveillance: Minimum (M) and Desirable (D) Surveillance Activities*

Condition under Surveillance	Federal Activities	State Activities
Work-Related Asthma	**M.** Periodic analysis of existing data sets (NHANES, NHIS, NOMS) **M.** Aggregation and analysis of State data	M. Include work variables in ongoing adult asthma surveillance efforts, where feasible. **M. Periodic analysis of existing relevant data in all States.** **M.** In-depth surveillance and follow-up in select States. **D.** In-depth surveillance and follow-up in all States.
Blood-borne Pathogen (BBP) Exposures in the Workplace	**M.** Aggregation and analysis of State data	**M. Counts of BBP exposures reported annually from institutional reporters in select States.** **D.** Further collection and analysis of BBP exposure data by industry, occupation and circumstance in select States.
Occupational Cancers	**M.** Counts of incident cases of mesothelioma and hemagiosarcoma of the liver using national cancer registry data. **M.** Periodic Analysis of NOMS data. **M.** Feasibility studies to assess utility of using cancer registry data for surveillance purposes, in collaboration with select States.	**M. Counts of incident cases of sentinel occupational cancers: mesothelioma and hemagiosarcoma in all States.** **M.** Feasibility studies to assess the utility of using cancer registry data for surveillance

Table 2. Matrix of Priority Conditions to be Placed under Surveillance: Minimum (M) and Desirable (D) Surveillance Activities*

Condition under Surveillance	Federal Activities	State Activities
	D. Nationwide counts of non-smoking lung cancer cases with I/O information.	purposes in select States. **D.** Counts of incident cases of non-smoking lung cancer cases with I/O information.
Elevated Blood Lead Levels (BLLs) among Adults	**M.** Aggregation and analysis of State data **D.** Suggest revisions to State surveillance programs based on research re BLLs < 25ug/dl.	**M. Mandate case reporting of BLLs >25ug/dl and conduct case follow-up in all States.** **D.** Collect and analyze all BL tests in a limited number of States.
Elevated Blood and Urine Levels of Arsenic, Cadmium and Mercury	**M.** Conduct feasibility assessment to determine extent of testing and available data.	Pending feasibility assessment
Work-Related Musculoskeletal Disorders of the Upper Extremities and Back	**M.** Analysis of ASOII data. **M.** Aggregation and analysis of State data.	**M. Periodic analysis of existing data, e.g. workers' compensation data, in all States.** **M.** In-depth surveillance and follow-up of specific conditions in select States. **D.** In-depth surveillance of specific conditions in all States

Noise-Induced Hearing Loss	**M.** Periodic analysis of existing data sets (NHIS/NHANES) **M.** Compilation of data OSHA & MSHA logs, NIOSH Hearing Loss Conservation Program. **M.** Aggregation/analysis of State data. **D.** Periodic audiometric and noise measurements by industry sector.	**M.** In-depth surveillance and follow-up in select States.
Occupational Skin Disease	**M.** Analysis of ASOII data. **M.** Periodic analysis of NHIS. **D.** Aggregation and analysis of State data.	**M. Periodic analysis of existing data sources in all States.** **D.** In-depth surveillance and follow-up in select States.
Pesticide-Related Illness and Injury	**M.** Aggregation and analysis of State data.	**M. Mandate reporting and tabulate reports and conduct follow-up of symptomatic cases in all States.** **D.** In-depth surveillance using additional data sources and more extensive case follow-up in 1 State in each EPA region. **D.** Hazard surveillance based on pesticide use data in select States.
Pneumoconiosis	**M.** Periodic analyses of NSSPM data. **M.** Periodic analyses of CW XSP, MSHA and ASOII data. **M.** Periodic analysis of OSHA/MSHA exposure sampling data. **D.** Aggregation and analysis of State data.	**M. Periodic analysis of death certificate data.** **M. Periodic analysis of hospital discharge data.** **M.** In-depth surveillance and follow-up, prioritized by age, in select States. **D.** Hazard surveillance in select States. **D.** In-depth surveillance and follow-up, prioritized by age, in all States.

Fatal Injuries	**M.** Aggregation and analysis of State data (CFOI & FACE)	**M. Use of multiple data sources to identify all occupational deaths in all States and annual reports(CFOI).** **M. Some follow-up of all fatalities in all States.** **M.** In-depth follow-up of select fatalities in select States including research oriented incident investigations and reports (FACE). **D.** FACE in all States.
Non-Fatal Injuries	**M.** Analysis of ASOII data; **M.** Maintain NEISS. **M.** Aggregation and analysis of State data.	**M. Periodic analysis of existing datasets in all States.** **M.** In-depth surveillance and follow-up of specific outcomes or special populations in select States. **M.** Broad-based surveillance of a spectrum of injuries using wider range of existing data sets in select States. **D.** Nationwide occupational injury surveillance system based on medical records.
Cardiovascular Disease (CVD)	**M.** Periodic analysis of NOMS and CFOI heart attack data. **D.** Secondary analysis of other existing data sets to profile CVD morbidity and mortality and CVD risk factors by industry and occupation (NHANES, NHIS, IMIS – hazard data)	**M. BRFSS surveillance by industry and occupation in select States** **D.** Analysis of hospital discharge/physician visit data by industry and occupation in select States.

Key: **M:** Minimal level of surveillance; **D:** Desirable level of surveillance; desirable is "in addition to minimal."

* Items noted in **BOLD** under State activities are under consideration as surveillance indicators to be placed under surveillance in all States.

Abbreviations:

ASOII: Annual Survey of Occupational Injuries and Illnesses
BRFSS: Behavioral Risk Factor Surveillance System
CFOI: Census of Fatal Occupational Injuries
CWXSP: Coal Workers' X-ray Surveillance Program
FACE: Fatality Assessment and Control Evaluation
MSHA: Mine Safety and Health Administration
NEISS: National Electronic Injury Surveillance System
NHANES: National Health and Nutrition Examination Survey
NHIS: National Health Interview Survey
IMIS: Integrated Management Information System
NOMS: National Occupational Mortality System
NSSPM: National Surveillance System for Pneumoconiosis Mortality
OSHA: Occupational Safety and Health Administration

Notes: Federal activity "aggregation and analysis of state data" includes provision of technical assistance and guidance to states, including efforts to facilitate standardization of data collection across states.

Federal analysis of national data should generate State-specific information whenever possible that is forwarded to the States.

References to analysis of ASOII data imply more extensive analysis than is currently carries out b BLS.

The term "in-depth surveillance and follow-up" means SENSOR type of surveillance systems that involve use of multiple data sources, case follow-up and intervention.

Appendix 5

Condition-specific Surveillance Profiles

1. Work-related Asthma
2. Blood Borne Pathogen Exposure
3. Occupational Cancers
4. Elevated Blood Lead Levels among Adults
5. Elevated Blood and Urine Levels of Arsenic, Cadmium, and Mercury
6. Work-related Musculoskeletal Disorders
7. Noise-Induced Hearing Loss
8. Occupational Skin Disorders
9. Pesticide-related Illness and Injury
10. Pneumoconiosis
11. Fatal Injuries
12. Nonfatal Injuries
13. Work-related Cardiovascular Disease

Profile for Work-Related Asthma

VI. Condition Under Surveillance

Work-related asthma (WRA) [incident and prevalent cases]

II Background and Justification

Asthma is a chronic inflammatory disease of the airways characterized by recurrent respiratory symptoms (wheezing, breathlessness, chest tightness, and coughing) and widespread variable airflow obstruction that is reversible either spontaneously or with treatment [National Heart, Lung, and Blood Institute, 1997]. The inflammatory process causes the airways to become hyperresponsive to a variety of chemical, biologic, and/or physical stimuli. An increase in asthma morbidity and mortality in recent decades stimulated development by NHLBI of the National Asthma Education and Prevention Program (NAEPP), directed primarily at improving recognition and medical management of asthma. The Centers for Disease Control and Prevention (CDC) is now proposing public health prevention programs. Recent data indicates that asthma affects nearly 15 million individuals in the U.S. and annually accounts for more than 100 million days of restricted activity, nearly 500,000 hospitalizations, and more than 5,000 deaths [National Heart, Lung, and Blood Institute, 1997]. Two-thirds of those affected are adults[Mannino et al., 1998], many of whom have work-related asthma (WRA) (see below).

WRA is defined functionally as symptomatic variable airflow obstruction caused or worsened by work or the work environment. For public health purposes, several major categories of WRA warrant prevention [Wagner and Wegman, 1998]. New-onset asthma due to occupational exposure to presumed sensitizing substances is generally associated with a latency period from first exposure until symptom onset. This category of WRA is limited to workers free of asthma-like symptoms immediately prior to first exposure, although a previous diagnosis of asthma (e.g., childhood asthma) does not necessarily preclude a finding of new-onset WRA [ACCP, 1995]. New-onset asthma due to occupational exposure to irritant substances is an increasingly recognized category of WRA. This condition has been called reactive airways dysfunction syndrome (RADS) when persistent asthma-like symptoms begin within 24 hours of an event, resulting in a very high level of exposure [Brooks et al., 1985]. Work-aggravated asthma is a category of WRA that refers to work-related worsening of symptoms, airflow obstruction, and/or nonspecific bronchial responsiveness in an individual who had recent asthma-like symptoms prior to first exposure to the implicated occupational cause.

WRA has emerged as an important public health problem in the industrialized countries over the last 10 to 15 years. In the United Kingdom and in British Columbia, WRA is the most frequently diagnosed and reported occupational respiratory disease [Ross et al., 1996; Contreras et al. 1994], and a growing list of over 250 different occupational agents have been implicated as causing WRA [Chan-Yeung and Malo 1995]. A study in Michigan has estimated

that up to 26% of adults hospitalized with asthma have WRA [Timmer and Rosenman, 1993]. A study involving a review of records from a health maintenance organization in Massachusetts estimated that 21% of incident asthma cases among adults is WRA [Milton, 1998]. These estimates suggest that about 2 million U.S. adults may suffer from WRA. Because conventional data sources do not generally specifically address WRA, comprehensive data on WRA throughout the U.S. are not readily available. In light of the increasing importance of this disorder, ongoing surveillance is needed to effectively guide public health prevention and intervention programs aimed at WRA. With funding from the NIOSH Sentinel Event Notification Systems for Occupational Risks (SENSOR) program, several states have developed WRA surveillance and intervention programs [CDC, 1990; Reilly et al., 1994]. The current SENSOR approach to WRA is based on case ascertainment through multiple data sources. To confirm and classify cases, state surveillance staff collect additional information about each case that is reported or otherwise ascertained, and direct prevention and/or intervention activities to individual workers, workplaces, employers, unions, trade associations, health care providers, etc. SENSOR WRA surveillance findings have not only confirmed well-recognized causes of asthma, but have identified new putative causes as well [Jajosky et al.]. SENSOR also provides a mechanism for improving the recognition, control, and prevention of WRA, and specifically for carrying out workplace evaluations aimed at primary prevention of WRA among unaffected co-workers of reported cases.

III. Goals for Surveillance

A. *State*

1. Trigger targeted prevention and intervention efforts based on the recognition of individual cases and case clusters of WRA within the state.
2. Estimate the public health impact of WRA in the state (overall, as well as by industry, occupation, work process, workplace agent, etc.) and monitor trends over time.
3. Demonstrate a need for public health resources for WRA and guide allocation of these resources to appropriate prevention and intervention programs at the state level.
4. Monitor effectiveness of WRA prevention and intervention efforts at the state level.
5. Identify industries, occupations, work processes, workplace agents, and special high-risk populations at the state level to guide WRA prevention and intervention programs.
6. Develop hypotheses leading to analytic studies about risk factors for WRA.

B. *National*

1. Trigger targeted prevention and intervention efforts based on the recognition of individual cases and case clusters of WRA (including clusters recognized through aggregation of data from multiple states).
2. Estimate the public health impact of WRA in the nation (overall, as well as by industry, occupation, work process, workplace agent, etc.) and monitor trends over time.

3. Demonstrate a need for public health resources for WRA and guide allocation of these resources to appropriate prevention and intervention programs at the national level.
4. Monitor effectiveness of WRA prevention and intervention efforts at the national level.
5. Identify industries, occupations, work processes, workplace agents, and special high-risk populations at the national level to guide WRA prevention and intervention programs.
6. Develop hypotheses leading to analytic studies about risk factors for WRA.

IV. Proposed Case Definition

Case definitions will vary by method and purpose. For state-based WRA surveillance, the current SENSOR/NIOSH case definition should be used. This requires meeting only two criteria: 1) health care provider's diagnosis consistent with asthma; and 2) an association between symptoms of asthma and work. (WRA cases can be classified into: 1) individuals newly sensitized by exposures at work; 2) persons with asthma caused by inhalation exposure to an irritant agent in the workplace, including reactive airways dysfunction syndrome (RADS); and 3) persons with pre-existing asthma exacerbated by workplace exposures.) Detailed guidance is available [Jajosky et al.]

Proposed Method of Surveillance

A. *Local*

Ascertainment of relevant information on work-relatedness of symptoms and on relevant industry and occupation should be included in local surveillance activities related to adult asthma, whenever feasible.

B. *State*

In all states and whenever technically feasible, relevant information on work-relatedness of symptoms and on relevant industry and occupation should be included in state surveillance activities relating to adult asthma. Appropriate analysis of this information should be carried out.

In addition, selected sentinel states should carry out more intensive WRA surveillance based on the SENSOR model, including:

1. Methods for case ascertainment should include:
   a) direct reporting of cases to state surveillance programs by health care providers and health care organizations;
   b) review of state workers' compensation data for cases with asthma; and
   c) review of hospital discharge data (and, if available, analogous data for outpatient visits) for cases with: i) primary or secondary diagnosis of asthma (ICD-9 493) **and** workers' compensation listed as principal payer; or

ii) primary or secondary diagnoses of respiratory condition due to chemical fumes or vapors (ICD-9 506) [NOTE: ICD-9 506 cases require additional information (e.g., from review of medical records) to confirm as WRA.]

2. Reported cases should be interviewed to obtain information for case classification.
3. Selected work sites should be inspected to obtain information regarding exposure(s).
4. Surveillance data should be periodically reported.
5. Surveillance data should be directly linked to prevention and intervention programs.

C. *National*

1. Ascertainment of relevant information on industry and occupation and appropriate analysis of data should be included in any national surveillance activities related to adult asthma, including periodic surveys such as NHIS and NHANES.
2. Morbidity odds ratio (MOR) or proportionate mortality ratio (PMR) analyses relating to the association of industries and/or occupations with asthma (ICD-9 493) should be done using NCHS multiple cause of death mortality data.
3. Surveillance data from sentinel states involved in WRA surveillance should be aggregated.
4. Surveillance data should be periodically reported.

V. Information Systems to Collect and Aggregate Data

1. Existing national data (e.g., Vital Statistics Mortality Data, NHANES data, and NHIS data).
2. For sentinel state surveillance of WRA: standardized computer application that takes into consideration formats for variables listed in the *Common Data Elements Implementation Guide* (Standards Committee, Health Information and Surveillance Systems Board, CDC). This application should allow states to more easily collect, maintain, and aggregate state-level data, as well as transmit selected data elements in standardized format to the national level.

VI. Partner Organizations/Other Agency Domains

Agency for Toxic Substances and Disease Registry (ATSDR)
American Association of Health Plans (AAHP)
American College of Occupational and Environmental Medicine (ACOEM)
American Lung Association (ALA)
American Public Health Association (APHA)
American Thoracic Society (ATS)
Association of Occupational and Environmental Clinics (AOEC)

Association of State and Territorial Health Officials (ASTHO)
Centers for Disease Control and Prevention (CDC)
Epidemiology Program Office (EPO)
National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP)
National Center for Environmental Health (NCEH)
National Center for Health Statistics (NCHS)
National Institute for Occupational Safety and Health (NIOSH)
Council of State and Territorial Epidemiologists (CSTE)
National Association of County and City Health Officials (NACCHO)
National Institutes of Health
National Heart, Lung, and Blood Institute (NHLBI)
Occupational Safety and Health Administration (OSHA)
Poison Control Centers (PCCs)
Society of Occupational and Environmental Health (SOEH)

VII. Strategic Planning

A. Minimal Level

1. Secondary analyses of relevant existing data at the national level.
2. Secondary analyses of relevant existing data by all states with relevant data.
1. Involvement of three sentinel states (each with large, different, and diverse industrial profiles) from different geographic regions of the country) in WRA surveillance following the SENSOR model.

B. Desirable Level of Surveillance for WRA (Minimum level plus)
Involvement of additional states up to and including all 50 states, the District of Columbia, and all U.S. territories in WRA surveillance following the SENSOR model.

VIII. Additional Comment

A 1997 CSTE position statement called for a more integrated and coordinated effort between NIOSH and NCEH to assist states in characterizing the occurrence and impact of asthma and to assure adequate intervention/prevention efforts. Future asthma funding initiatives for public health should be considered opportunities to enhance such integration/coordination.

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Appendices

Appendix A
Work-Related Asthma Reporting Guidelines for State Surveillance Programs

State surveillance programs should encourage health care professionals to report all diagnosed or suspected cases of work-related asthma. Reported cases include individuals newly sensitized by exposures at work, persons with asthma caused by inhalation exposure to an irritant agent in the workplace, including reactive airways disease syndrome (RADS) (5), and persons with pre-existing asthma exacerbated by workplace exposures.

Appendix B
Work-Related Asthma Case Definition for State Surveillance Programs

A. Health care professional's diagnosis consistent with asthma*
   AND
B. An association between symptoms of asthma and work.+

Asthma is a clinical syndrome characterized by inflammation of the tracheobronchial tree associated with increased responsiveness to a variety of stimuli (3). Symptoms of asthma include episodic wheezing, chest tightness, cough, and dyspnea, or recurrent attacks of "bronchitis" with cough, sputum production, and rhinitis (4). The primary physiologic manifestation of airways hyperresponsiveness is variable or reversible airflow obstruction, which may be demonstrated by significant changes in the forced expiratory volume in one second (FEV_1) or peak expiratory flow rate (PEFR). Airflow changes can occur spontaneously, with treatment, with a precipitating exposure, or with diagnostic maneuvers such as nonspecific inhalation challenge.

Patterns of association can vary, and include: 1) symptoms of asthma develop or worsen after a worker starts a new job or after new materials are introduced on a job (a substantial period of time may elapse between initial exposure and development of symptoms); 2) symptoms develop within minutes of specific activities or exposures at work; 3) delayed symptoms occur several hours after exposure, during the evenings of workdays; 4) symptoms occur less frequently or not at all on days away from work and on vacations; 5) symptoms occur more frequently on returning to work; 6) symptoms occur in clear association with a workplace exposure to an agent with irritant properties. Patterns of association may also include work-related changes in medication requirements.

Appendix C.
Work-Related Asthma Case Classification Criteria for State Surveillance Programs

Preexisting asthma that was symptomatic and/or treated with asthma medication within the 2 years prior to entering the occupational setting associated with the patient's asthma symptoms;
New asthma symptoms that develop within 24 hours after an acute high level inhalation exposure (at work) to an irritant gas, fume, smoke, or vapor and that persist for at least three months;

C3) Workplace exposure to an agent previously associated with occupational asthma*;

C4) Work-related changes in serially measured FEV_1 or PEFR+;

C5) Work-related changes in bronchial responsiveness as measured by serial nonspecific inhalation challenge testing§;

C6) Positive response to specific inhalation challenge testing¶ with an agent to which the patient has been exposed at work.

* Many agents can induce occupational asthma via a specific hypersensitivity mechanism. A comprehensive list of these inducers of asthma (6,7) is used for this criterion of the surveillance case definition. Known asthma inducers have been integrated into the Association of Occupational and Environmental Clinics coding scheme (Internet location of coding scheme: http://occ-env-med.mc.duke.edu/oem/aoec.htm).

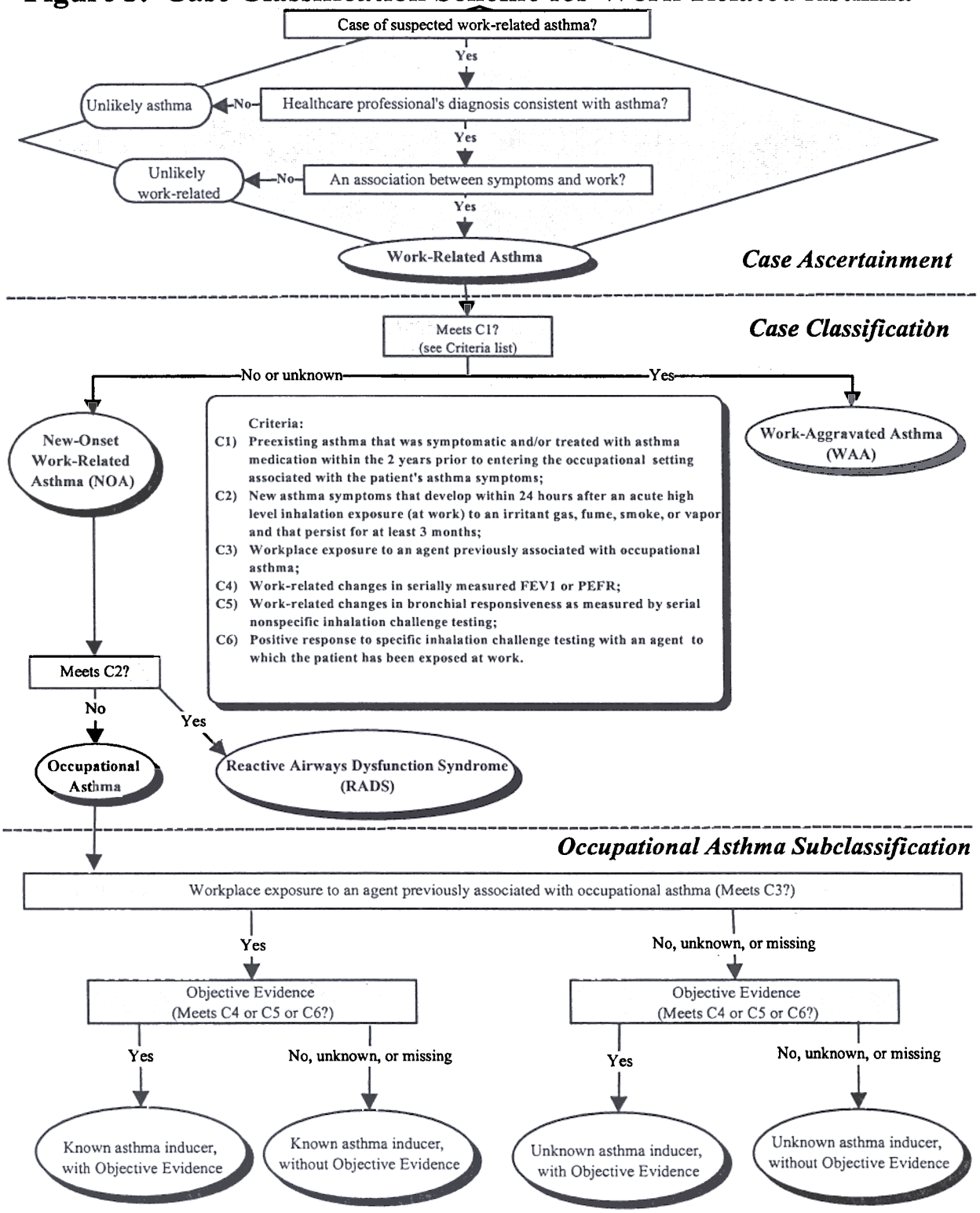
\+ Spirometric measurements (e.g., FEV_1) can be obtained before and after the work shift (i.e., cross-shift spirometry). However, many cases of occupational asthma may fail to demonstrate a significant cross-shift reduction in FEV_1, either due to a delayed bronchoconstrictor response or due to intermittent exposure patterns. Cases not identified by a single cross-shift test, due to absence of exposure on the chosen test date, may be identified by cross-shift spirometry testing on multiple days. Alternatively, peak expiratory flow rates can be measured serially throughout the day using a portable peak flow meter. Workers can be instructed on the proper use of peak flow meters.

§ Changes in nonspecific bronchial responsiveness can be measured by serial inhalation challenge testing (e.g., using methacholine or histamine). Evidence of work-relatedness is manifested by increased bronchial responsiveness (bronchoconstriction at lower inhaled doses of methacholine or histamine) following work exposures and decreased or normal bronchial responsiveness after a period away from work.

¶ Specific inhalation challenge testing has distinct objectives: 1) to identify previously unrecognized causes of occupational asthma; 2) to confirm a diagnosis of occupational asthma; and 3) to identify the causative agent when more than one allergen is present in the occupational environment and where identification of the causative agent is essential for management. Specific inhalation challenge testing is potentially dangerous and should be performed by

experienced personnel in a hospital setting where resuscitation facilities are available and where frequent observations can be made over sufficient time to monitor for delayed reactions. Specific inhalation challenge is not necessary for public health surveillance of occupational asthma and is generally not necessary for clinical diagnosis of occupational asthma.

Figure 3. Case Classification Scheme for Work-Related Asthma



Profile for Blood Borne Pathogen Exposures

I. Conditions under Surveillance

Bloodborne pathogen exposures: hepatitis B virus (HBV), hepatitis C virus (HBC), human immunodeficiency virus (HIV).

II. Background and Justification

Injuries from contaminated needles and other sharp devices used in the health care setting have been associated with transmission of bloodborne pathogens to health care workers. More than 20 pathogens have been transmitted through sharp and needlestick injuries. Of these, HIV, HBV, and HCV pose the greatest risk to health care workers. Depending on the setting, health care workers face a significant risk of exposure to these pathogens. An emergency seroprevalence study found that 18percent of patients were seropositive for HCV, 5 percent were seropositive for HBV, and 6 percent were seropositive for HIV. An estimated 1.25 million people in the U.S. are chronically infected with HBV. The seroprevalence of HIV among patients in inner city hospitals ranges from 4.1 to 8.9 per 100 patients, and in suburban hospitals from 0.2 to 6.1 per 100 patients. An estimated 4 million people in the U.S. are infected with HCV.

The prevalence of hepatitis B among health care workers is three to five times higher than the general population. The risk of acquiring hepatitis B after needlestick injury ranges from 10 to 35 percent. Health care workers at greatest risk are in areas with direct exposure to blood, such as emergency rooms, clinical laboratories, operating rooms and hemodialysis units. Most HBV infections result in complete recovery and immunity from future infection; in 5 to10 percent of adult cases, however, inability to clear the virus from liver cells results in chronic HBV infection. Chronic HBV infection has been linked to increased risk of cirrhosis and liver cancer; approximately 15 to 25 percent of chronically infected persons are expected to die prematurely from these causes. Hepatitis B infection in health care workers has been estimated to have declined following promulgation of the Bloodborne Pathogens standard, from 5,000 new cases in 1991 to 800 new cases in 1995. The HBV infection incidence rate for health care workers is now lower than the incidence rate for the general U.S. population.

Hepatitis C virus (HCV) infection is the most common chronic bloodborne infection in the United States. The Centers for Disease Control and Prevention (CDC) estimates that during the 1980s, an average of 230,000 new infections occurred each year. Although since 1989 the annual number of new infections has declined by >80 percent to 36,000 by 1996, data from the Third National Health and Nutrition Examination Survey (NHANES III), conducted from 1988-1994, have indicated that an estimated 3.9 million (1.8 percent) Americans have been infected with HCV. Population-based studies indicate that 40 percent of chronic liver disease is HCV-related, resulting in an estimated 8,000-10,000 deaths each year. Current estimates of

medical and work-loss costs of HCV-related acute and chronic liver disease are more than $600 million annually, and HCV-associated end-stage liver disease is the most frequent indication for liver transplantation among adults. HCV is transmitted primarily through large or repeated direct percutaneous exposures to blood. Injecting-drug currently accounts for 60 percent of HCV transmission in the United States. Needlestick injuries are the most common cause of occupational HCV exposures. The risk of infection following needlestick injury ranges from 3 to 10 percent. In 1995, an estimated 560 to 1,120 cases of HCV infection occurred among health care workers who were occupationally exposed to blood. Up to 85 percent of all HCV-infected persons develop chronic infection, with increased risk of cirrhosis and primary hepatocellular carcinoma.

The average risk of HIV infection after a needlestick exposure to HIV-infected blood is 0.3 percent or 1 in 100. As of 1996, the CDC had received reports of 52 documented cases and 114 possible cases of occupationally acquired HIV infection among US health care workers. Of these 52 documented cases of occupationally acquired HIV infection, 45 resulted from sticks or cuts. Although the risk of seroconversion after a needlestick is relatively rare, injured health care workers may suffer disabling physical side effects from post-exposure anti-viral medication as well as emotional trauma while awaiting test results.

Hospital-based health care workers are reported to experience about 600,000 needlestick injuries per year. Approximately 2 percent or 16,000 of these are likely to be contaminated by HIV. Needlestick injuries account for up to 80 percent of all accidental exposures to blood. In one study the cost to hospitals of sharps injuries averaged over $24,000 per year. Surveillance of needlestick injuries from hospitals shows an overall rate of 27 per occupied bed per year. Most exposure incidents occur in patients' rooms (37 percent), operating rooms (16 percent), the emergency department (7 percent) or the critical care units (6 percent). Nurses report the most frequent exposures (50 percent), followed by physicians (13 percent), nursing assistants (5 percent) and housekeeper/laundry workers (5 percent). Hollow bore needles are responsible for the majority (69 percent) of all needlestick injuries. Five primary activities are responsible for the majority of needlestick injuries: disposing of needles, administering injections, drawing blood, recapping needles and handling trash or dirty linens. Needlestick injuries are underreported by 40 to 60 percent of nurses and 70 to 95 percent of physicians. Staff nurses are estimated to sustain almost one needlestick injury per year.

Safer needle devices have been shown to significantly reduce the incidence of accidental needlesticks and exposure to potentially fatal bloodborne illnesses. Safer needle devices incorporate engineering controls to prevent needlestick injuries before, during or after use through built-in safety features. Almost 83 percent of injuries from hollowbore needles can be prevented by the use of devices that have safety features or eliminate the use of needles altogether (e.g., needleless IV connectors, self re-sheathing needles, and blunted surgical needles). The Federal and Drug Administration (FDA) and other researchers have

recommended design features for these safety devices. Collection and evaluation of needlestick injury data by hospitals are key to identifying injury patterns and then implementing an effective engineering control plan to reduce the incidence of injury. Devices should be selected that are clinically effective, acceptable to users, and maximally effective in reducing needlestick injuries in that particular setting. Section (d)(2)(I) of the OSHA Bloodborne Pathogen Standard requires the use of engineering and work practice controls to eliminate of minimize employee exposure (29 CFR 1910.1030). California has recently become the first State to require the use of safer needle devices under their Bloodborne Pathogen standard. Federal OSHA requests information and comments on engineering and work practice controls used to eliminate or minimize the risk of exposure to bloodborne pathogens due to percutaneous injuries from contaminated needles and other contaminated sharps in occupational environments.

III. Goals for Surveillance (Local/State/National)

A. *Local*

Identify sources of data of bloodborne pathogen exposure to HBV, HBC, and HIV (hospitals, skilled nursing facilities, home health agencies, correctional health care facilities).

2. Facilitate implementation of safety-enhanced devices to reduce exposure to bloodborne pathogens.
3. Assess the effectiveness of local exposure control measures in reducing the incidence of exposures to bloodborne pathogens.

B. *State*

Identify and collect data on bloodborne pathogen exposures.
Analyze data on the incidence of bloodborne pathogen exposure to determine risk factors and priorities for intervention.

2. Encourage the development and use of medical devices to maximize worker and patient safety.
3. Evaluate compliance with Federal and state guidelines and regulations regarding bloodborne pathogen exposure.

C. *National*

1. Aggregate and interpret data on the incidence of bloodborne pathogen exposures.
2. Monitor trends on the implementation of safety-enhanced devices.
3. Partner with national agencies and organizations in the assessment of compliance with Federal guidelines and standards for the prevention of bloodborne pathogen exposures.
4. Obtain Federal funding for surveillance and prevention/control activities at the State and Federal level.

IV. Proposed Case Definition

All percutaneous and mucous membrane health care worker occupational exposures to the bloodborne pathogens hepatitis B virus, hepatitis C virus and human immunodeficiency virus.

V. Proposed Method of Surveillance

A. *Data sources*

Institutional reports of health care worker occupational exposures to bloodborne pathogens.

B. *Data to be collected*

Local

None.

2. *State*

Develop targeted surveillance system of institutional reporters (e.g., "sentinel network") of participating hospitals, skilled nursing facilities, home health agencies, and correctional health care facilities.

Demographic, occupational and risk factor data on exposures, to include: circumstances of injury, types, and brands of devices involved in percutaneous and mucous membrance injuries, and use of safety-enhanced devices.

3. *National*

Demographic and occupational data on the demographic and occupational characteristics of bloodborne pathogen exposure in selected health care institutions.

C. *Levels of surveillance*

Minimal Level:

Number of bloodborne pathogen exposures reported yearly from each institutional reporter

Desirable Level:

Incidence of bloodborne pathogen exposures by occupation, location, circumstance, and type of device

VI. **Information Systems to Collect and Aggregate Data**

Participating state health departments should compile surveillance data on health care worker bloodborne pathogen exposures in a standardized format and report them electronically to CDC. Content of case reports and standardization of variables should be further developed as a collaborative effort with NIOSH.

VII. Partner Organizations/Other Agency Domains

A. *Essential Organizations*

Council of State and Territorial Epidemiologists
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
Occupational Safety and Health Administration

B. *Stakeholders*

Association of Practitioners of Infection Control
American Hospital Association
Service Employees International Union
American Nursing Association

VIII. **Strategic Planning**

A. *Implementation*

1. Development of criteria for selection of institutional reporters.
2. Establishment of core variables for bloodborne pathogen exposure surveillance.
3. Development and testing of standardized database systems for data collection.
4. Recruitment and selection of institutional reporters.
5. Pilot testing of surveillance system over five years in three participating states.
6. Establishment of national surveillance system in all states.

B *Resources*

Two FTEs in all states with ideal reporting system.

C. *Questions*

Resources and capacity of institutional reporters to collect and report data

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I. Conditions under Surveillance

Occupational cancers

II. Background and Justification

Cancer is a significant cause of morbidity and mortality in the United States with approximately 1,228,600 new cases of invasive cancer and 565,000 cancer deaths expected during 1998.[1] Estimates of the proportion of cancer in the US due to occupational exposure range from 2-8 percent. [2] Applying a mid-range estimate of 4 percent to the national mortality and morbidity figures suggests that over 22,000 deaths and close to 50,000 incident cases of cancer in the United States each year are occupationally related. Several million US workers are potentially exposed to substances classified by the International Agency for Research on Cancer as human carcinogens.

The proportion of cancer due to occupation varies by cancer site. For example, it is estimated that approximately 10 percent of lung cancers and 21 to 27 percent of bladder cancers among men in the general US population are related to occupational exposure to recognized carcinogens.[345] Several cancers including mesothelioma and hemangiosarcoma of the liver can be considered sentinel occupational cancers. These are cancers that have a very high occupational attributable fraction and are defined by Rutstein as "inherently occupational."[6] It has been suggested that lung cancers in non-smokers are largely attributable to occupational exposures and that surveillance of these cancers may lead to the identification of occupational risk factors.

There are two major public health data sources that are used for cancer surveillance: death certificates and cancer registry reports. Death certificate information collected at the state level is routinely forwarded to the National Center for Health Statistics (NCHS) where it is aggregated to generate national mortality statistics. The Standard Certificate of Death includes information about usual industry and occupation (I/O) of the decedent. Through a collaborative effort of NCHS, NCI, NIOSH, and state health departments, the data on industry and occupation are currently coded in 21 states. Death certificates data from these states are aggregated to form the National Occupational Mortality Surveillance System (NOMS), which is available as a public use data set. Cancer registries, which collect information about newly diagnosed cancer cases, now exist in 50 states; 45 states, Washington, DC and 3 territories are currently funded through the National Program of Cancer Registries (NPCR) within the National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP) at CDC. In 1992, the Cancer Registries Amendment Act required collection of occupation or industry data to the extent available in the same record by registries funded by NPCR.[7] In 1997, 44 registries reported that they collect some information about usual industry and occupation on incident cases. Sixteen states reported that they code the data.[8] The registries voluntarily submit anonymous data to the North American Association of Central Cancer Registries

(NAACCR), a private, non-profit organization, for analysis and publication of aggregate data across the states. In 1998, 40 states provided data to NAACCR. Industry and occupation information are not currently included in the NAACCR data set. CDC, in collaboration with partner organizations including NAACCR, is implementing efforts towards aggregation of multi-state data and generation of a public use data set.

Cancer registries offer the advantage of providing information about all incident cases, and have better diagnostic information. Death certificates currently have more complete information about usual industry and occupation.

II. Goals for Surveillance

State and National

- Generate/lend support to hypotheses about occupation/cancer associations that require further etiologic research.
- Monitor trends of sentinel occupational cancers over time to:
- Document the magnitude/public health impact of the problem;
- Evaluate efforts to prevent these cancers; and
- Potentially, identify new settings where interventions may be needed.

IV. Proposed Surveillance Case Definition

ICD-9 and ICD-O codes for cancers to be monitored.

For the two sentinel occupational cancers, ICD-O codes:

Cancer	ICD-O
Mesothelioma	9050-9053
Hemangiosarcoma of the liver	9120/3.

For lung cancer in non-smokers:

ICD-O codes C340-C349 ***and*** reported as a non-smoker.

V. Proposed Method of Surveillance

Morbidity: Inclusion of usual industry and occupation as well as smoking information as core variables collected at the local level on all newly diagnoses cancer cases and transmitted to the state health department or its designee. Routine automated and manual coding of I/O data at state level using standardize coding system (Bureau of Census).

Minimal

- Routine counting and reporting of incident cases of mesothelioma and hemangiosarcoma of the liver by NAACCR/NIOSH. Data should be reported for the nation and for states.

Desirable

- Routine reporting of incident cases of lung cancer in non-smokers coupled with industry and occupation information by NCCDPHP (NPCR) and NIOSH. Data should be reported for the nation and for states.
- Pending results of an initial surveillance research/evaluation phase. See strategic planning below.

Mortality

- Hypothesis generating studies based on periodic (and/or rolling) analysis of death certificate NOMS data from 21 states to ___.

VI. Information Systems to Be Utilized to Collect and Transmit Information

a. The source for morbidity data: statewide central cancer registries or data aggregated across states by NPCR.

b. The source for mortality data: state health departments/vital registries participating in NOMS

VII. Partner Organizations/Other Agency Domains

A. *State Health Departments* are the primary data source. Other partner organizations include:

American Cancer Society (ACS)
Association of State and Territorial Health Officials (ASTHO)
Council of State and Territorial Epidemiologists (CSTE)
National Association for Public Health Statistics and Information Systems (NAPHSIS)
National Cancer Registrars Association (NCRA)
North American Association of Central Cancer Registries (NAACCR)

B. *Federal Agencies*

Centers for Disease Control and Prevention (CDC)
Division of Cancer Prevention and Control (DCPC)
National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP)
National Center for Health Statistics (NCHS)

National Institute for Occupational Safety and Health (NIOSH)
National Institutes for Health (NIH)
National Cancer Institute (NCI)
National Institute for Environmental Health Sciences (NIEHS)
Environmental Protection Agency (EPA)
Occupational Safety and Health Administration (OSHA)

VIII. Strategic Planning

- **Implementation**

At a minimum, annual counts of sentinel occupational cancers should be generated for the nation and for the states. NIOSH should work with NPCR to determine if national level data can be routinely generated. State level data can either be generated at the state or, especially for rare cancers, state specific findings from the national database can be fed back to state programs. Ideally, state and national level counts of lung cancer in non-smokers coupled with industry and occupation information should also be generated.

Periodic broad-based and/or rolling targeted analyses of NOMS data should continue. In addition, hypothesis-generating/screening research using cancer registry data should be undertaken in several states and/or using data aggregated across states that currently collect and code I/O data and the utility of this approach formally evaluated. The added value of using incident data rather than mortality data should also be formally assessed. Studies to assess alternative models of collecting more extensive occupation and industry data in select cancer registries should also be conducted. NIOSH should work with NCI, NPCR, NAACCR, and states in this effort.

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Profile for Elevated Blood Lead Levels Among Adults

I. Condition under Surveillance

Elevated Blood Lead Levels Among Adults

II. Background and Justification

Lead is not an essential element nor does it serve any useful purpose in the body. It adversely affects multiple organ systems and can cause permanent damage. Research shows that lead has adverse health effects, including reproductive hazards, at levels once believed safe.

Lead poisoning is a persistent, mainly occupational, health problem among adults. Despite the fact that sources of lead exposure and effective preventive measures have been known for decades, occupational lead exposure continues to be an important public health problem.

The single best diagnostic test for lead exposure is the blood lead level (BLL). The federal Occupational Safety and Health Administration's (OSHA) regulations to protect workers from lead-associated health effects include requirements for monitoring BLLs among employees who meet certain exposure criteria.

The feasibility and utility of laboratory-based surveillance of BLLs for adults and children have been documented in many states. CDC currently supports adult lead toxicity surveillance activities and collects data from 27 State health departments. Data from the CDC's Adult Blood Lead Epidemiology and Surveillance Program for 1997 indicated that 12,716 individuals from 27 reporting states had blood lead levels >=25 μg/dL, including 777 individuals with blood levels >=50 μg/dL. Extrapolated to the entire U.S., this suggests that about 18,000 adults had BLLs >=25 μg/dL and about 1,100 had BLLs >=50 μg/dL in 1997. The most recent analysis of the nationwide adult blood lead data suggest that the number of persons with BLLs >=25 μg/dL has been relatively constant since 1994.[2] Surveillance data may underestimate the prevalence of adult lead toxicity because not all workers with significant lead exposure are being tested appropriately for BLL.

Reporting of elevated BLLs by clinical laboratories to State occupational lead surveillance systems has led to a wide variety of public health prevention and intervention activities, including industrial hygiene on-site consultations at lead-using work sites, referrals to OSHA for enforcement actions, referral of exposed workers to physicians for clinical follow-up, education of reported individuals and their physicians, and targeted outreach to high-risk industries.

Lead exposure at work can also affect the families and children of lead exposed workers. A meta-analysis of several studies has suggested that about one third of the children of lead-exposed workers have BLLs >=10 μg/dL. Lead contamination in the homes of workers who have brought lead dust home on their clothing has been documented.

III. Goals for Surveillance

A. *Local*

1. Identify individual cases and clusters of elevated BLLs among adults to trigger interventions through collaboration with state.
2. Identify and target for screening the children of lead-exposed workers, and make referrals to childhood lead poisoning surveillance programs as appropriate.

B. *State*

1. Identify individual cases and clusters of elevated BLLs;
2. Assess public health impacts by analyzing state and local patterns of elevated BLLs in adults and measure trends.
3. Identify high-risk workers and their employers to target interventions.
4. Use surveillance data to guide analytic studies.
5. Monitor and assure appropriate prevention and control activities for adults with elevated BLLs and their families, including sharing of data with agencies responsible for enforcement of occupational health standards and referral of adults with non-occupational exposure to appropriate public health agencies.
6. Demonstrate need and obtain/allocate resources for occupational lead surveillance and control activities.

C. *National*

1. Assess the public health impact of elevated BLLs among adults and measure trends.
2. Identify high-risk population subgroups to target interventions.
3. Evaluate prevention activities including screening programs and efforts to reduce environmental and occupational lead exposure.
4. Use surveillance data to guide analytic studies and the process for setting and revising lead health standards.
5. Demonstrate the need for public health surveillance programs and resources in adult lead toxicity, and allocate resources at the federal, state, and local levels.

IV Proposed Surveillance Case Definition

A. An adult (16 or older) is considered to have an elevated BLL if a venous sample >=25 µg/dL.

B. An adult (16 or older) is considered to have an urgent sentinel health event if a venous blood sample is >= 40 µg/dL.

V. Proposed Method of Surveillance

Local and State

Minimal Level

1. All states should mandate, collect, and tabulate reports from clinical laboratories of individuals with BLLs >= 40 µg/dL. (Laboratory-based reporting of BLLs to states and state agencies is the primary source of data. In most states, regulatory authority for reporting resides in the state health department; however in a few states, this authority is with the state labor or environmental departments.)
2. Reports should include basic demographic and occupational data, including name and address of employer where lead exposure occurred. Personal identifiers must be collected to differentiate between new (i.e. individuals who were not reported in the previous year) and ongoing cases.
3. All States, at a minimum, should follow up on reported individuals with BLLs >= 40 µg/dL to determine the source of exposure and to initiate prevention activities. Follow-up investigations by states (or as delegated to other agencies including local departments of health or OSHA) of adults with elevated BLLs should collect data on medical follow-up, potential sources of lead exposure, and results of occupational investigations.

Desirable Level

1. Reporting and case follow-up by state agencies should be initiated on individuals with BLLs of 25 µg/dL or greater.
2. In some states, physician reporting of adults with elevated BLLs may supplement laboratory reporting.
3. elected states with regulations requiring reporting of all blood lead tests, regardless of level, are encouraged to computerize all test results and analyze the data to determine true trends in testing and BLLs by industry over time.

National

Minimal Level

State health or labor departments forward data, without personal identifiers, on adults with elevated BLLs to CDC for data aggregation and dissemination.

Desirable Level

NIOSH should continue to evaluate the potential adverse health effects of BLLs less than 25 µg/dL, and, if appropriate, recommend changes in state surveillance and intervention policies and federal regulations based on these findings.

Information Systems to Collect and Aggregate Data

State health departments should compile adult lead surveillance data in a standardized format and send them electronically to CDC. Content of the case reports and standardizing of variables should be further developed as a collaboration between the Council of State and Territorial Epidemiologists (CSTE) and CDC.

Partner Organizations/Other Agency Domains

A. *Essential Partners*

Association of Public Health Laboratorians (APHL)
Association of State and Territorial Health Officials (ASTHO)
Centers for Disease Control and Prevention (CDC)
    National Institute for Occupational Safety and Health (NIOSH)
    National Center for Environmental Health (NCEH)
Council of State and Territorial Epidemiologists (CSTE)
State Childhood Lead Poisoning Prevention Programs

B. *Other Partners*

Agencies in state with responsibilities for oversight of lead abatement work (housing, environmental, labor, industry)
Federal Bureau of Labor Statistics
Federal/state Occupational Safety and Health Administration
Industry and labor organizations (unions)
Organizations of public health professionals involved in occupational and environmental health issues

VIII. Resources

1. Most states will require at least two FTEs and support from their management information systems staff to conduct the minimum core public health functions of adult lead surveillance.
2. At least 1.5 FTE are necessary at NIOSH to coordinate state-based activities, and compile and disseminate information.

Profile for Elevated Blood and Urine Levels of Arsenic, Cadmium, and Mercury

I. Condition Under Surveillance

Elevated blood and urine levels of arsenic, cadmium and mercury among adults.

II. Background and Justification

Arsenic

Potential occupational exposures involving inhalation or skin absorption of arsenic may occur during mining and smelting of metal ores; during metallurgic processes for hardening copper, lead, and alloys; from the production and use of pigments, pesticides, fungicides, and wood preservatives; and during the manufacture of glass and semiconductors (1). In the 1980's, there were approximately 55,000 workers in occupations with potential exposure to arsenic compounds (2). Arsenic compounds are irritants of the skin, mucous membranes, and eyes. Acute arsenic poisoning rarely occurs in occupational settings and usually involves ingestion of contaminated food or drink (3). Occupational exposure to inorganic arsenic compounds may result in irritation of the upper respiratory tract, hyperpigmentation of the skin, and hyperkeratosis of palmar and plantar surfaces (4). In a large number of occupational studies, exposure is causally associated with cancer, primarily of the skin and lungs (5,6).

Routine screening methods involving laboratory diagnostic tests for arsenic exposure have been developed and validated for blood and urine (2). Measurements of blood arsenic levels reflect exposure within the very recent past (last several hours), while urine arsenic levels are reflective of exposure during the last few days. Total urinary arsenic levels may include nontoxic organic arsenic from ingestion of fish and consequently may overestimate exposures to inorganic arsenic species which are of health concern. Both blood and urine levels of arsenic may not be reliable indicators of chronic exposure to low levels of arsenic. The current OSHA arsenic standard includes the following requirements for medical surveillance of workers exposed to arsenic: medical and occupational history, chest x-ray, nasal and skin examination, and other examinations deemed appropriate by the attending physician. Biological testing of arsenic levels is not explicitly required by the standard. In 1995, there were 15 States which had mandatory reporting requirements (either lab or hospital) for heavy metal poisoning (other than lead) (7).

Existing data with potential for hazard surveillance for occupational arsenic exposure include the Integrated Management Information System (IMIS). IMIS is a computerized database of OSHA inspection and industrial hygiene data for States with federal OSHA enforcement. OSHA State-plan States' data may be included but are less complete. Although a limited number of establishments is inspected each year, this database includes actual environmental levels.

The International Agency for Research on Cancer (IARC) considers arsenic compounds to be a

1A carcinogen (2). The Occupational Safety and Health Administration (OSHA) has PEL TWAs for inorganic and organic arsenic compounds (10 $\mu g/m^3$ and 500 $\mu g/m^3$) (6).

Cadmium

Cadmium may be used in the workplace as an anticorrosive in electroplated steel, as an electrode in alkaline batteries, and as a component in alloys, silver solders, and welding rods (1). Results from the National Occupational Exposure Survey (NOES) conducted by the National Institute for Occupational Safety and Health (NIOSH) indicated approximately 89,000 workers occupationally exposed to cadmium in the early 1980's (8). Highest levels would be expected to occur in job tasks involving heating cadmium-containing products by smelting, welding, soldering, or electroplating and also in processes associated with producing cadmium powders (9). Cadmium fumes and dusts are pulmonary irritants and may cause nephrotoxicity. Acute health effects from occupational exposures include pulmonary edema and interstitial pneumonitis while chronic effects include kidney disease, emphysema, bone lesions, and prostate and lung cancer (10).

Routine screening methods involving laboratory diagnostic tests for cadmium exposure have been developed and validated for blood and urine (11). Measurements of blood cadmium levels reflect mainly recent exposure to cadmium rather than body burden (12). Urinary cadmium levels reflect primarily total body burden rather than recent exposure (1). Urinary levels of cadmium are only a confirmation of absorption and are not indicative of duration or severity of exposure. The current OSHA standard requires that employers are required to conduct medical surveillance and biological monitoring of certain presently and historically exposed cadmium workers. Required tests include biological monitoring of blood cadmium, urine cadmium, and urinary beta-2-microglobulin, an indicator of kidney damage not specific to cadmium. As of 1997, there were 6 States conducting occupational surveillance involving blood and urine cadmium levels (10). In approximately 12 ½ years, New Jersey identified 320 adults with elevated cadmium levels of which 51 percent were exposed occupationally, 10 percent were exposed nonoccupationally, and 38 percent had a source of exposure which was unknown (10). Existing data with potential for hazard surveillance for occupational cadmium exposure include the IMIS.

The IARC has determined that there is sufficient evidence in humans of the carcinogenicity of cadmium and has categorized cadmium as a 2A carcinogen (11). The OSHA PEL TWA for cadmium is 5 $\mu g/m^3$ (11).

Mercury

Mercury consists of three basic forms (metallic, inorganic and organic) and is used in the workplace in the manufacture of electrical meters, industrial control instruments, and batteries, as catalysts and fungicides, in pharmaceuticals and for general laboratory use (13). Sectors employing the largest numbers of exposed workers are health services, dental medicine, chemical products, electrical equipment manufacturing, and mining (14). Most occupational exposures occur as a result of breathing air that contains mercury vapors. In the early 1980's there were approximately 70,000 workers in the United States with potential occupational exposures to mercury (14). Potential health effects from exposure to mercury include damage to the brain, kidneys, developing fetus, lungs and gastro-intestinal system (14).

Blood and urine mercury concentrations have been often used as biomarkers of exposure to mercury. Studies of occupational exposure show that blood and urine concentrations are good indicators of recent mercury exposure (15). Measurement of mercury in whole blood is used to estimate recent exposure to organic mercury including methyl mercury in fish. Mercury in urine is recommended to test for exposure to metallic mercury vapors and to inorganic forms of mercury. In 1995, there were 15 States which had mandatory reporting requirements for heavy metal poisoning (other than lead)(7). Existing data with potential for hazard surveillance for occupational mercury exposure include the IMIS.

The OSHA has PEL for all forms of mercury is 0.1 mg/m^3 (12). OSHA has no comprehensive standard nor requirements for medical surveillance or biological monitoring.

III. Goals for Surveillance

A. *Local*

None

B. *State*

1. Identify individual adult cases and clusters of elevated heavy metal levels.
2. Assess public health impacts by analyzing state and local patterns of elevated heavy metal levels among adults and heavy metal hazard data.
3. Identify high risk subpopulations suitable for planning and evaluating screening strategies at the local and state levels.
4. Monitor effectiveness of state-wide prevention and control activities for adults with elevated heavy metal levels.
5. Produce summary analyses suitable for justifying state and federal funding for surveillance and prevention/control activities.

C. *National*

1. Assess the public health impact of elevated heavy metal levels among adults.
2. Analyze state and national characteristics of adult elevated heavy metal levels and heavy metal hazards.
3. Monitor trends of adult elevated heavy metal levels and heavy metal hazards.
4. Evaluate prevention activities including screening programs and efforts to reduce environmental and occupational heavy metal exposure.
5. Summarize data suitable for monitoring and improving laboratory proficiency in heavy metal analyses.
6. Produce summary analyses suitable for justifying federal funding for surveillance and prevention/control activities at the state and local level.

IV. Proposed Case Definitions

A An adult (16 years of age or older) is considered to have an elevated arsenic level if:

1. Blood arsenic level is equal to or greater than .07 μg/ml or
2. Urine arsenic level is equal to or greater than 100 μg/L.

B. An adult (16 years of age or older) is considered to have an elevated cadmium level if: 1 Blood cadmium level is equal to or greater than 5 μg/L of whole blood or
2. Urine cadmium level is equal to or greater than 3 μg/gram creatinine.

C. An adult (16 years of age or older) is considered to have an elevate mercury level if:

1. Blood mercury level is equal to or greater than 2.8 μg/dL or
2. Urine mercury level is equal to or greater than 20 μg/L.

V. Proposed Method of Surveillance (Local/State/National)

Data sources

Laboratory reporting of elevated heavy metal levels among adults.
IMIS, TRI databases for heavy metals at worksites.

Data to be collected

A. *Local*

1. None.

B. *State*

1. Reports of elevated heavy metals from public and private laboratories departments including demographic and occupational information, if available.
2. Additional demographic, occupational and exposure information from selected case and employer follow-up.
3. IMIS data for heavy metals for the state.

C. *National*

1. Demographic and occupational data for all adults with elevated heavy metals collected by state health or labor departments.
2. IMIS data for heavy metals for the nation.

Levels of Surveillance

A. Planning prior to implementation
B. Conduct feasiblity assessment:
   - determine actual extent of workplace biomonitoring for arsenic, cadmium, and mercury;
   - review and contact states with mandatory laboratory reporting in order to evaluate actual reporting compliance and characteristics;
   - evaluate and finalize biological criteria for case definitions;
   - work with CDC NCEH, ATSDR, and EPA to assess feasibility and support for expanding profile to include environmental exposures involving adults and children.

Minimal Level

1. Laboratory reports in States currently with mandatory reporting of elevated heavy metal levels. Case follow-up to determine work-relatedness.
2. IMIS data for heavy metals for the States with mandatory reporting.

Ideal Level

1. IMIS data for heavy metals for all states, analyses reported periodically by NIOSH. 2. Laboratory reports and possible other data sources (e.g, medically billing records for lab tests) in selected States with large numbers of employees at potential risk of exposure to heavy metals.
3. Selected case and employer follow-up for additional information.
4. Intervention recommendations for selected worksites.

Information Systems to Collect and Aggregate Data

Participating state health departments should compile surveillance data for adult elevated heavy metal levels in a standardized format and send these data electronically to CDC. Content of the case reports and standardization of variables should be further developed as a collaborative effort between the Council of State and Territorial Epidemiologists (CSTE) and NIOSH.

Partner Organizations/Other Agency Domains

A. *Essential Partners*

Association of Public Health Laboratories (APHL)
Association of State and Territorial Health Officials (ASTHO)
Centers for Disease Control and Prevention (CDC)

National Institute for Occupational Safety and Health (NIOSH)
Council of State and Territorial Epidemiologists (CSTE)
Environmental Protection Agency (EPA)
National Association of County and City Health Officials (NACCHO)
Occupational Safety and Health Administration (OSHA)

B. *Stakeholders*
Relevant industry organizations
Relevant labor organizations

VIII. Strategic Planning

Implementation

A. Conduct feasibility assessment.
B. If appropriate, conduct minimal surveillance for a period of three years and evaluate the appropriateness of expansion to ideal system of surveillance.

Resources

A. ½ FTE for each state health department with mandatory reporting.
B. Computer hardware and software.

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Profile for Work-Related Musculoskeletal Disorders of the Upper Extremities and Lower Back

I. Condition Under Surveillance

Work-related musculoskeletal disorders include upper extremity disorders such chronic low back pain, and other musculoskeletal conditions. Because of their prevalence, cost, and relationship to work factors, the primary focus of surveillance would be on two major subgroups of musculoskeletal disorders. These two subgroups are: 1) work-related musculoskeletal disorders of the upper extremity and 2) work-related musculoskeletal disorders of the back.

II. Background and Justification

According to the 1998 National Occupational Research Agenda (NORA) update, "Musculoskeletal problems are the largest single problem facing American workers today,costing between $13 and $20 billion annually." (1) The Bureau of Labor Statistics estimates that in 1994 approximately 705,800 cases of occupational injuries and illnesses involving days away from work resulted from overexertion or repetitive motion. For carpal tunnel syndrome (CTS) alone, in 1994 BLS reports a rate for cases that resulted in days away from work of 4.8 per 10,000 workers. (2) There is evidence that BLS data undercounts certain types of musculoskeletal disorders and does not provide detailed characteristics of the work settings giving rise to the injuries and illnesses. For example, Washington State (3) reported an incidence rate of 31.7 CTS workers' compensation cases per 10,000 workers (most of which did not involve time off of work). Based on data from the National Health Interview Survey, Behrens et al. (4) reported that 4.5 percent of a nationally representative sample of adults who had worked in the previous 12 months experienced work-related back pain from repeated activities. As detailed in two recent extensive reviews of the state of knowledge related to musculoskeletal disorders and work (5,6), there is strong epidemiologic and biomechanical evidence linking the physical demands of work, such as repetitive motion, lifting, and bending, with the occurrence of musculoskeletal conditions. There is also evidence that interventions can reduce the reported rate of these disorders in specific industries and occupations. However, both of the recent summaries of the literature report on important gaps in the level of information about musculoskeletal disorders. There is insufficient or incomplete information about the rates of musculoskeletal disorders in the general population, many targeted populations, and in specific industries or occupations.

III. GOALS FOR SURVEILLANCE:

Local

1. Identify cases and clusters to trigger appropriate prevention and control activities.
2. Assess impact of musculoskeletal disorders on community health care, employment, and disability services.
3. Inform community health assessment activities.
4. Target and evaluate intervention programs.

State

1. Identify cases and clusters to trigger appropriate prevention and control activities.
2. Assess impact of musculoskeletal disorders on health care needs, employment, and disability services.
3. Monitor trends statewide or in certain areas.
4. Target and evaluate intervention programs. Provide data and information to local health agencies and state businesses.
5. Assess the impact of musculoskeletal disorders in targeted populations, such as older workers, minorities, young workers.
6. Monitor, the social, disability and economic costs associated with these disorders.

National

1. Identify risk factors amenable to prevention through investigation of cases and clusters.
2. Monitor trends in the occurrence of musculoskeletal disorders to detect and respond to new or increasingly burdensome hazards.
3. Demonstrate magnitude of problems in terms of lost work time, healthcare costs, and disease.
4. Develop standard case-definitions, prevention strategies, and clinical guidelines.
5. Facilitate development of research applications.
6. Generate data and information to assist with regulatory development and evaluation.
7. Generate more complete and accurate estimates of musculoskeletal disorders in the general and working population through supplemental surveillance systems that use overlapping sources of ascertainment.

IV Proposed Case Definition

Various definitions have been used for work-related musculoskeletal conditions, depending on the location of the disorder, purpose, particular concern, or nature of the investigation. These include case definitions based on clinical pathology, symptomatology, work disability, or other measures which take into account different stages of the disease process. Thus any surveillance effort must develop or adapt precise surveillance definitions for the specific musculoskeletal disorders included in the surveillance system. Recognizing these limitations, the recent National Academy of Sciences Report notes: "The musculoskeletal conditions that may be caused by (nonaccidental) physical work activities include disorders of inflammation, degeneration, and physiological disruption of muscles, tendons, ligaments, nerves, synovia, and cartilage involving limbs and trunk. These entities are included in categories 353-355, 722-724, and 726-729 of the International Classification of Diseases (commonly referred to as (ICD-9)(World Health Organization, 1977). Not every disorder in these categories may be caused by mechanical stressors, but all the major musculoskeletal disorders of interest are included in these groupings. Common examples are low back strain, tenosynovitis, and carpal tunnel syndrome." (6) In addition,non-specific musculoskeletal pain and other symptoms associated with work, often without a clear diagnosis, are very common and should be investigated for inclusion in specific

surveillance systems. Because of their prevalence, cost, and severity, the primary focus would be on two major subgroups of musculoskeletal disorders:

A. Work-related musculoskeletal disorders of the upper extremity including carpal tunnel syndrome, hand/wrist tendinitis, epicondylitis, deQuervains tenosynovitis, bursitis, etc., and
B. Work-related cumulative musculoskeletal disorders of the back (e.g. chronic low back pain).

V. Proposed Method of Surveillance

Because the group of work-related musculoskeletal disorders includes a number of important conditions that are detected, treated, and compensated quite differently, it will be necessary to develop specific plans for surveillance of each of the two primary subgroups. For each disorder, surveillance sources might be quite different. For example, low back pain is a prevalent disorder that is primarily defined by symptoms, and thus may not be detectable by systems based on information on treatment (e.g., surgery). Workers' compensation data, though an important source of information, must be considered in a local and state context, because there is substantial variation in the percentage and types of conditions compensated among states and sectors of the economy. The following summary lists some of the suggested sources of data at the national and state level.

A. Data Sources
   1. Local
      - Voluntary collaboration among unions, businesses, and/or carriers to report and evaluate illness and injury data. These data would typically not include elements identifying either businesses or individuals.
      - Aggregate data on workers' compensation cases for specific communities.
      - Information on prevention programs conducted by major employers, unions, or industry associations that might include summary data.
      - Information from targeted health care providers, clinics, hospitals, or health maintenance organizations.
   2. State
      - For a subset of states, the surveillance system would collect detailed information on all cases within the state or a defined portion of the state (SENSOR model). Because of the substantial prevalence of these disorders, it may be necessary to limit the scope of surveillance in terms of time, location, level of intervention, and type of condition. The actual system would depend on the condition(s) surveyed. For work-related upper extremity disorders, ascertainment sources might include: cases filed for workers' compensation, physician reports, hospital discharge data, physical therapists, ambulatory surgery practices, and other individualized state sources. For work-related cumulative back disorders, case ascertainment sources might include cases filed for workers' compensation, physician reports, emergency departments, health maintenance organizations or health care insurers, disability reports, physical therapists, or other

individualized state sources.
State-specific BLS (or state entity contracted to provide) annual survey data.

3. National
   - Bureau of Labor Statistics Annual Survey of injuries and illnesses including relevant injuries (especially strains and sprains) and illnesses (particularly "disorders due to repetitive trauma").

   Data on musculoskeletal symptoms and history of chronic conditions is collected through systems designed to evaluate national samples of the U.S. population, such as NHANES and NHIS. The work-relatedness of the symptoms and conditions should continue to be addressed.
   Other national or regional data systems that might catalog medical care utilization, such as physician visits.

B. Level of Surveillance
   1. Minimal
      - Review of BLS Annual Survey data delineated in as much detail as possible to include all musculoskeletal disorders, including strains and sprains by body location (fingers, hand/wrist, elbow, shoulder, neck, back, etc.). These data should be summarized for each state.
      - Review of aggregate data for each state using previously collected data, such as cases filed for workers' compensation, health insurer information, or other information available to particular states.
      - Select states or localities to focus on active surveillance to generate rates of specific conditions, complete prevalence, and rates by industry and occupation. Describe magnitude of specific conditions with greater accuracy using multiple data systems already collecting data.
      - Active surveillance systems should include continued interaction and feedback with both the reporters (e.g., physicians, hospitals) and the affected population (e.g., industry, unions, trade associations).
      - Implementation of interventions in selected locations based on the identification of hazards through surveillance, and application of known or new strategies to prevent musculoskeletal disorders.

   2. Desirable
      - Coordinated surveillance plan for each of several key musculoskeletal disorders such as carpal tunnel syndrome, other upper extremity repetitive strain injuries, and low back pain that would identify appropriate data sources, case definitions, and geographic distribution of surveillance. This could also include collaboration with other entities collecting data on musculoskeletal disorders or prevalence of known hazard such as insurers, employers, government agencies and unions to encourage comparability.
      - Pooling of data among states to confirm suspected hazards, contributing factors, and preventive methods.
      - Targeting specific regions for surveillance based on prevalence of high-risk industries or

representativeness of population.

VI. Information Systems to Collect and Aggregate Data

Because musculoskeletal disorders include conditions with variable development in terms of standardization and surveillance, the ultimate goal of reporting combined data to CDC would require significant investment in defining standard case definitions, variables to be reported, case ascertainment sources, and minimum and maximum levels of investigation and intervention. These efforts would probably move forward one condition at a time.

Partner Organizations/Other Agency Domains

A. *Essential Partners*

Accident and Injury Boards
Bureau of Labor Statistics
Centers for Disease Control and Prevention
National Institute Occupational Safety and Health
State Health Departments
Workers' Compensation Boards

B. *Stakeholders*

Industry Representatives
Insurance Carriers
Labor unions
Physicians and other health care providers, e.g., rehabilitation specialists
OSHA
Other government health agencies: NCHS, AHCPR, NIH, HCFA, etc.

Strategic Planning Questions

- Carpal Tunnel Syndrome surveillance has been supported by SENSOR--how should these efforts be directed in the future? Are other musculoskeletal conditions appropriate for this model?
- What are OSHA's surveillance output and needs in regards to the promulgation and enforcement of the possible upcoming ergonomics standard?
- There are many complicated and political issues surrounding musculoskeletal disorders. For example, there are multiple outcomes included and there are well recognized non-occupational risk factors involved. Given the environment, what types of surveillance systems can be successfully launched?
- A number of other stakeholders, such as compensation insurers, state workers' compensation boards (or other designated agencies), unions, and certain industries are heavily involved in counting and evaluating musculoskeletal disorders. Many of these analysis efforts, especially among insurers and employers, have not so far been shared with academic or government investigators. What methods should we explore to encourage collaboration with these entities to improve our surveillance and coordination of data ?

How should states use state-generated surveillance data of musculoskeletal disorders to tie into the extensive NIOSH and industry investment in research related to musculoskeletal disorders?

What are the responsibilities of the state surveillance systems to share their surveillance with the public and other stakeholders?

Previous research has clearly identified specific working conditions, such as those requiring repetition, force, or extreme postures, that are associated with musculoskeletal disorders. The surveillance of specific hazards could effectively and efficiently lead to primary prevention efforts. What are NIOSH and state priorities for hazard surveillance in this area?

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Profile for Noise-Induced Hearing Loss

VIII. Condition under surveillance

Sensorineural hearing loss caused by the cumulative effect of prolonged exposure to noise.

II. Background and Justification

There are an estimated 10 million people in the United States with noise-induced hearing loss (1). OSHA estimates there are one million workers in manufacturing who have sustained job-related hearing impairment (greater than 25 dB average threshold hearing loss at 1,2,and 3 KHZ) (2).

There are an estimated 30 million workers exposed to noise at 85 dBA or greater (3). The NIOSH draft criteria document recommends an exposure level of 85 dBA. The current OSHA standard is 90 dBA time weighted average.

Hearing impairment is significantly associated with multiple negative outcomes including depression, loneliness, altered self-esteem and diminished function (4,5).

The cost for worker compensation claims for hearing loss from 1977-1987 was estimated at $800 million (6).

Data from the 1990-1991 National Health Interview Survey show that 19.9 percent of men with hearing loss were told by a medical person their hearing loss was work related and 14.3 percent of men told a medical person their hearing loss was work related. For women the percentages were 2.4 percent and 1.6 percent respectively (7).

One state, Michigan, receives funds in the NIOSH SENSOR program to perform surveillance for work-related noise-induced hearing loss. Approximately 2,000 reports are received annually (8).

III Goals for Surveillance (local, state, national)

Local

To identify individual cases and clusters of hearing loss; to trigger appropriate prevention and control activities; to evaluate and target screening strategies at the community level; and to assess the effectiveness of hearing loss prevention activities.

State

To identify individual cases and clusters of hearing loss; to assure appropriate prevention and control activities; to describe the extent of elevated hearing loss by likely source of exposure; to evaluate and target screening strategies; and to evaluate and target intervention strategies.

National

To assess the public health impact; to monitor trends; to evaluate prevention activities, including screening programs and efforts to reduce noise levels; to demonstrate the need for noise prevention programs, and to help allocate resources for prevention activities.

IV. Proposed Case Definition

1. A history of significant exposure to noise at work and;
2. A standard threshold shift (STS) of 10 dB or more in either ear at an average of 2000, 3000, and 4000 Hz or;
3. A standard threshold shift (STS) of 15 dB or more in either ear at 500, 1000, 2000, 3000, 4000, or 6000 Hz which is confirmed by immediate retesting or;
4. A fixed loss in either ear of 25 **(units?)**or greater loss at an average of 500, 1000 and 2000 Hz or 1000, 2000, 3000 Hz or 3000, 4000, and 6000 Hz.

V. Proposed Method of Surveillance (local, state, national)

Minimal level

Periodic review of the NHIS and NHANES databases of the percentage of individuals with hearing loss and percentage secondary to noise at work.

Collection and compilation of hearing loss data from OSHA and the MSHA log and the NIOSH Hearing Conservation and Audiometric Data Base Analysis.

Desirable Level

In depth surveillance in geographically representative states. These geographically representative states should to be representative of the different industries in the United States. These surveillance systems would include collection of data from health care practitioners, hospitals, and workers' compensation files. Special emphasis should be given to the collection of data from practitioners not associated with hearing conservation programs so as to identify companies/industries needing such programs.

Periodic audiometric and noise measurements (hazard surveillance) by industry sector.

VI. Information Systems to Collect and Aggregate Data

Geographically representative states should compile work-related hearing loss data in a standardized format and send them electronically to CDC. These data should be combined with data from National Data systems to produce an annual report of work-related hearing loss in the United States. These reports need to provide state specific data for dissemination within states.

VII. Partner Organizations/Other Agency Domains

Centers for Disease Control and Prevention (CDC)

National Institute for Occupational Safety and Health (NIOSH)
Council of State and Territorial Epidemiologists (CSTE)
Specialty Health Care Provider Societies
Hearing and Speech Associations
Hearing Conservation Associations
Academies of Audiologists
Otolaryngology Societies
Graduate Schools of Audiology
Mine Safety and Health Administration (MSHA)
Occupational Safety and Health Administration (OSHA)

VIII Strategic Planning

The Physical Agents Effects Branch (PAEB) of NIOSH should be provided the resources and assigned the responsibility of producing an annual work-related noise induced hearing loss report for the United States.

Geographically representative states should be funded to work with the PAEB to develop surveillance systems that complement the National databases.

NIOSH will need to collaborate with MSHA and OSHA to obtain data from their injury and illness logs. NIOSH will periodically have to provide funds to NHIS and NHANES to obtain data on hearing loss. NIOSH also needs to collaborate with the appropriate National Institute of Health division responsible for hearing disorders. Ideally, surveillance for work-related noise induced hearing loss would be part of a larger surveillance system for both work- and non-work related noise-induced hearing loss.

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Profile for Occupational Skin Diseases

I Condition Under Surveillance

Occupational Skin Disease

II. Background and Justification

According to the U.S. Bureau of Labor Statistics (BLS), occupational skin diseases (OSD) are the second most common type of occupational disease. During the period from 1992 to 1996, allergic and irritant contact dermatitis accounted for 12 percent to 14 percent of all reported occupational diseases. In the workplace the skin is an important route of exposure to chemicals and other contaminants. There are thousands of potentially harmful new chemicals introduced into the workplace each year, adding to the potential threat of rapidly emerging skin diseases such as latex allergies. There is virtually no industry or occupation without potential exposure to the many varied agents that cause allergic and irritant contact dermatitis.

The 1988 National Health Interview Survey (NHIS) reported that 2.8 percent of the population were affected by contact dermatitis and 1.7 percent (1.87 million) experienced contact dermatitis that could be attributed to the workplace. Data collected from the 1993 BLS survey of employers resulted in an estimate of 7.6 per 10,000 workers annually developing OSD, for all of private industry in the United States. Employers may not be fully aware of the extent of the problem: responses to the 1988 National Health Interview Survey's Occupational Health Supplement indicated that less than 23 percent of the respondents who reported both occupational skin disease and contact with noxious substances at work made this information known to management. Extrapolation of the results of earlier BLS surveys suggest that as many as 1.65 million workers annually develop skin disorders from occupational exposures. However, the results of active surveillance, medical screenings, and worksite investigations disclose that work-related skin disease prevalence may be many times greater in specific industries.

Past research has determined that, once afflicted, a large proportion of occupational disease cases never achieve complete resolution, despite optimal medical attention and/or job changes. Reexaminations of contact dermatitis cases 6 months to 8 years post diagnosis, by a number of researchers, have documented that chronic skin disease may develop more than half the time. This persistent nature of the disease, the sequelae associated with dermal sensitization, and the huge financial burden it imposes, estimated at $1 billion annually by Mathias, dictate that prevention be emphasized.

Allergic and irritant contact dermatitis were included as priority research areas under the 1996 National Occupational Research Agenda primarily because of their high prevalence rates, estimates of which vary widely; the poor prognosis for a significant proportion of those afflicted; and the general lack of knowledge necessary for the development of effective prevention programs.

Prevention of occupational skin disease involves the identification of causes of the conditions, determination of which working populations or workplaces are at high risk, and the development of preventive techniques and control technology. Skin disease prevention and control could involve a combination of intervention strategies that include modification of engineering, administrative, and housekeeping; the use of personal protective equipment, and implementation of training programs.

Occupational skin diseases became a condition for SENSOR surveillance in 1992. Currently two states (Washington and Oregon) are involved in the active surveillance of occupational skin diseases through the NIOSH SENSOR program. Underreporting of OSD has been identified by states currently active in OSD surveillance. Passive reporting systems, such as BLS and workers' compensation, underreport incidence and prevalence. A high priority for these surveillance systems is to determine the impact of underreporting.

III. Goals for Surveillance

State

1. To identify individual cases of occupational skin disease; to identify clusters of occupational skin diseases.
2. To identify industries and occupations associated with occupational skin diseases.
3. To assure appropriate prevention and control activities.
4. To monitor outbreaks.
5. To generate research hypothesis.
6. To target and evaluate intervention programs

National

1. To assess the public health impact of occupational skin disease.
2. To monitor trends.
3. To evaluate prevention activities.
4. To demonstrate the need for intervention programs.
5. To allocate resources for intervention activities.

IV. Proposed Case Definition

Have a history of an occupational exposure, present with a skin disorder and not be a repeat visit for the same problem within a six-month period of time and be defined by ANSI Z16.2 nature of injury codes 180, 181, 182, 183, 184 or 189 or an equivalent coding system.

V. Proposed Method of Surveillance

Surveillance activity would be focused at the state and national level. Local surveillance activities, while potentially beneficial, are not viewed as feasible given the surveillance methods.

Minimal Level

National

Aggregation and analysis of data from various sources, including available state surveillance data, as well as BLS and NHIS data.

State

Secondary analysis of existing data, e.g., workers' compensation data, in all states

Desirable Level

State

All occupational skin diseases will be included in the surveillance system. Cases are identified using workers' compensation claims, with all claims with "nature of injury" codes 180 - 189 being included in the surveillance system.

A second source of case identification is physician reporting. Mandatory physician reporting is required in states with active OSD surveillance. A network of sentinel providers allows a window into cases that are not seen in the workers' compensation system (i.e. self-insured).

Worksite follow-up activity should be initiated when there is a cluster of cases (3 cases or 2 percent of the workforce) at the same worksite within a 3-month period of time; an industry, occupation or process not previously associated with occupational skin disease is identified; per request of the employers; or at the request of the sentinel provider.

OSD surveillance activity would be ongoing. Conceivably the goals of this program could be met by establishing surveillance systems in a limited number (5) of states with diverse industries and diverse reporting systems.

National

Aggregation and analysis of data from various sources, including state surveillance data as well as BLS and NHIS data.

VI Information Systems to Collect and Aggregate Data

State health departments should compile data on occupational skin disease in a standardized format and send electronically to CDC on an annual basis. CDC would then compile a national data set. The variables to be collected and a standardized format for that collection will be developed by CSTE and NIOSH.

Partner Organizations/Other Agency Domains

American Academy of Dermatology
American Contact Dermatitis Society
Bureau of Labor Statistics
Centers for Disease Control and Prevention
    National Institute for Occupational Safety and Health
Council of State and Territorial Epidemiologists
North American Contact Dermatitis Research Group
Occupational Safety and Health Administration
Sentinel Providers/Dermatologists
State Health Departments
State Labor Council
Workers' Compensation Insurers, Administrators and State Workers' Compensation
    Regulators

Strategic Questions

- The magnitude of the problem is addressed, but effectiveness of intervention methods for prevention are not well researched.
- The role of OSHA with OSD's is not as effective.
- Research to increase the understanding of sensitization rates and the burden of disease are necessary.
- An important role for surveillance of OSD should be hypothesis-generating.
- The need for sentinel provider reporting needs to be balanced with the burden this places on practitioners.
- A stronger collaborative role with occupational dermatologists is needed.
- Measures are needed to effectively address latex allergy problems particularly in the health care field.
- Need for research to determine the extent of underreporting in passive reporting systems like BLS and workers' compensation.
- State to state variations maybe difficult to understand given the variations in workers' compensation law, insurer policies, and so on.

Resources

The operation of an OSD surveillance component requires administrative, epidemiologic and industrial hygiene support. Recommended resources for a state project include 2 FTEs. It is recommended that there be a full time epidemiologist, half time industrial hygienist and half time administrative support.

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Profile for Pesticide-Related Illnesses and Injuries

I. Condition under Surveillance

Acute Occupational Pesticide-related Illness and Injury

II. Background and Justification

Pesticides are defined under the Federal Insecticide Fungicide and Rodenticide Act (FIFRA) as any substance or mixture of substances intended to prevent, destroy, repel or mitigate insects, rodents, nematodes, fungi, weeds, microorganisms, or any other form of life declared to be a pest by the Administrator of the U.S. Environmental Protection Agency (EPA) and any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant. Pesticides include herbicides, insecticides, rodenticides, fungicides, disinfectants, wood treatment products, growth regulators, insect repellents, etc.

Pesticides, by design, are toxic to certain life forms. Currently in the US, there are over 17,000 registered pesticide products and over 800 active ingredients. Seventy-six percent of pesticide usage (approximately 950 million pounds) occurs in the agricultural industry, and 23 percent (approximately 294 million pounds) occurs in the urban sector (US EPA, 1997).

Acute pesticide-related illness and injury continues to be a problem. According to poison control center data, there are approximately 18,000 unintentional symptomatic pesticide exposures per year. Approximately 1,400 of these are occupational (Blondell, 1997). According to Bureau of Labor Statistics (BLS) data, annually there are 500-900 lost work-time illnesses caused by pesticide exposure. Finally, there are approximately 15 to20 death certificates per year that contain codes for unintentional pesticide poisoning. All of these estimates are thought to be underestimates of the true incidence of unintentional acute pesticide-related illness and injury.

Acute pesticide-related illness and injury can be prevented. Efforts are needed to protect workers and consumers from pesticide hazards. Such efforts should include increased education about the use and hazards of pesticides, elimination or reduction of pesticide exposures, and substitution with safer alternatives. To this end, the Council of State and Territorial Epidemiologists (CSTE) adopted in 1996 a resolution to add acute pesticide-related illness and injury as a condition reportable to the National Public Health Surveillance System (NPHSS).

III. Goals for Surveillance (Local/State/National)

A. Local

1. Identity individual cases and clusters of acute occupational pesticide-related illness and injury.

2. Trigger appropriate prevention and control activities for individuals with acute occupational pesticide-related illness and injury.

3 Provide information, direction, and advice on the use and hazards of pesticides to those at risk of pesticide poisoning, eliminating or reducing exposures to pesticides, and mitigating the effects of exposures that occur.

B. *State*

1. Identify individual cases and clusters of acute occupational pesticide-related illness and injury.
2. Assure appropriate prevention and control activities for individuals with acute occupational pesticide-related illness and injury.
3. Analyze patterns of acute pesticide-related illness and injury by likely source of exposure.
4. Develop, target, and evaluate intervention and regulatory programs.
5. Provide information, direction, and advice on the use and hazards of pesticides to those at risk of pesticide poisoning; eliminating or reducing exposures to pesticides, and mitigating the effects of exposures that occur.
6. Integrate the surveillance of acute occupational and non-occupational pesticide-related illness and injury.
7. Obtain federal and state funding for acute occupational pesticide-related illness and injury surveillance and control activities.

C. *National*

1. Demonstrate the need for acute occupational pesticide-related illness and injury prevention programs.
2. Analyze the public health impact of acute occupational pesticide-related illness and injury.
3. Evaluate prevention activities and efforts to reduce environmental and occupational pesticide exposure.
4. Obtain federal funding for acute pesticide-related illness and injury surveillance and pesticide exposure control activities at the state and local levels.
5. Integrate the surveillance of acute occupational and non-occupational pesticide- related illness and injury.
6. Partner with agencies and organizations (public and private) in assessment, policy development, and regulatory functions.

IV. Proposed Case Definition

A case definition was developed by experts from federal agencies (NIOSH, EPA, National Center for Environmental Health), non-federal agencies (Council of State and Territorial Epidemiologists, Association of Occupational and Environmental Clinics), and state health departments or other state designees. A copy of the complete 19-page case definition is available upon request. The case definition requires the collection of information in three areas: pesticide exposure, health effects, and evidence supporting a causal relationship between exposure and effect. A case is reportable to the NPHSS when there is:

1. Documentation of two or more adverse health effects that are temporally-related to a documented pesticide exposure; AND
2. Consistent evidence of a causal relationship between the pesticide and the health effects based on the known toxicology of the pesticide from commonly available toxicology texts, government publications, information supplied by the manufacturer, or two or more case-series or positive epidemiologic investigations; OR
3. Insufficient toxicologic information is available to determine whether a causal relationship exists between the pesticide exposure and the health effects. (This involves circumstances where minimal human health effects data is available, or where there are less than two published case-series or positive epidemiologic studies linking health effects to the putative exposure agent.)

A case of acute pesticide-related illness or injury is classified as being either definite, probable, possible, or suspicious. The specific classification category is chosen depending on the level of certainty of exposure, whether health effects were observed by a health care provider, and whether there is sufficient toxicologic information to support a causal relationship between the exposure and health effects. When sufficient evidence for an exposure-health effect relationship is not present, the case is classified as "unlikely". A classification of "not a case" is assigned when there is strong evidence that no pesticide exposure occurred, when no post-exposure abnormal symptoms were reported, or when there is definite evidence of a non-pesticide causal agent.

A case will be classified as occupational if exposure occurs while at work (this includes: persons working for compensation; persons working in a family business, including a family farm; persons working for pay at home; and, persons working as a volunteer Emergency Medical Technician (EMT), firefighter, or law enforcement officer). All other cases will be classified as non-occupational.

III Proposed Method of Surveillance

Local and State

Minimal Level

1. All states should mandate, collect, and tabulate reports of acute pesticide-related illness and injury from physicians, poison control centers, and workers' compensation systems.
2. Reports should include basic demographic and occupational data. In addition, personal identifiers must be collected to conduct follow-up and to identify duplicate reporting of cases from different sources.
5. Follow-up should be conducted on all cases that report adverse health effects subsequent to pesticide exposure. The follow-up should obtain the information necessary to classify the case into the appropriate case definition category (including information on health effects on exposure and the acquisition of medical records). Follow-up investigations can be conducted by state health departments or in collaboration with other agencies, including state

departments of agriculture or their local designees.

6 Data for all cases should be computerized in a format that will permit aggregation of data from all states.

7 States should distribute educational and informational materials on recognizing and preventing pesticide toxicity.

8 There should be immediate referral to NIOSH, EPA, and other appropriate agencies when: imminent danger is present due to a pesticide exposure; there is a cluster of cases involving four or more workers; and serious illness results from use of a pesticide product in accordance with the label.

9 An annual report describing the findings of the surveillance system should be produced and distributed to health care providers, governmental agencies, and other interested parties.

Desirable level

1. Several other useful reporting sources for acute pesticide-related illness and injury cases should be considered for utilization. These include the State Departments of Agriculture, other health care providers, hospital discharge records, hospital emergency department records, death certificates, and other State agencies (e.g., State Structural Pest Control Agencies or Licensing Boards).
2. Laboratory reporting of blood cholinesterase levels or other tests of pesticide exposure (including the performance of environmental and biological testing as appropriate).
3. Pesticide use data would be helpful. For each specific pesticide, this could include pounds of pesticides applied, number of containers of pesticides, number of applications, and acres treated. Using this information as denominator data could help identify problematic pesticides. The usefulness of this approach has been demonstrated in California (Weinbaum et al., 1997).
4. Conduct in-depth follow-up investigations on selected pesticide-related illness events based on the seriousness of the poisoning, the likelihood of ongoing pesticide over-exposure, and/or the estimated number of workers at risk.
5. Conduct intervention activities for the purpose of prevention and evaluate the effectiveness of these activities.
6. Create and distribute educational and informational materials on recognizing and preventing pesticide toxicity.

National

Minimal Level

1. State health or labor departments must pass along data on acute pesticide-related illness and injury to CDC for data aggregation and dissemination. Aggregation will permit assessment of trends, magnitude of disease, and permit identification of emerging pesticide hazards and populations at risk. Aggregated data should be made available to government agencies, academic institutions, and other investigators with a need to know.
2. Coordinate efforts with other agencies such as EPA and NCEH/CDC.

Desirable level

1. Assist States with conducting intervention activities for the purpose of prevention. Assistance should also be provided to States to evaluate these intervention activities.
2. Assist States with creating and distributing educational and informational materials on recognizing and preventing pesticide toxicity.
3. Ensure that laws, regulations, and practices are adequate to protect workers, the public, and the environment.
4. Ensure that adequate resources are available to accomplish these tasks.

IV. Information Systems to Collect And Aggregate Data

State health departments should compile acute pesticide-related illness and injury reports in a standardized format and send them electronically to CDC through an e-mail file transfer. Software for data entry has been developed by the New York State Department of Health in collaboration with NIOSH. This software is available to interested States. The database provides for entry of all standardized variables for pesticide-related illness and injury. The standardized variables were developed by experts from federal agencies (NIOSH, EPA, National Center for Environmental Health), non-federal agencies (Council of State and Territorial Epidemiologists, Association of Occupational and Environmental Clinics), and state health departments or other state designees.

V. Partner Organizations/Other Agency Domains

A. *Essential Partners*

Association of State and Territorial Health Officials (ASTHO)
Centers for Disease Control and Prevention (CDC)
National Institute for Occupational Safety and Health (NIOSH)
Council of State and Territorial Epidemiologists (CSTE)
U.S. Environmental Protection Agency (US EPA)

B. *Other Agency Partners*

Agencies in state with responsibilities for pesticides (agriculture, labor, environment, industry, cooperative extension)
Agromedicine Programs
Federal Bureau of Labor Statistics
Federal/state Occupational Safety and Health Administration
Industry and labor organizations
Poison Control Centers
Workers' Compensation Boards
Workers' Compensation Insurers

VI Strategic Planning

A. *Implementation*

1. Surveillance of acute pesticide-related illness and injury should be considered a core public health function of state-based occupational health programs.
2. All states should, at a minimum, collect reports of acute pesticide-related illness and injury and conduct follow-up to determine sources of exposure and to initiate prevention/control activities in cooperation with essential partners.
3. States with sufficient resources should collect information from all available sources and set priorities for follow-up.
4. At least one state in each of the 10 EPA regions should collect information from all available sources and set priorities for follow-up.

B. *Resources*

1. Most states will require at least 1.0 FTE and support from their management information systems staff to conduct the minimum core public health functions of pesticide-related illness and injury surveillance.
2. At least 1 FTE is necessary at NIOSH to coordinate state-based activities, and aggregate and disseminate information.

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Profile for Pneumoconiosis

Condition under Surveillance
Pneumoconioses (in aggregate, as well as by type, e.g., asbestosis, coal-workers' pneumoconiosis (CWP), silicosis, etc.)

II. Background and Justification

Pneumoconioses are preventable non-malignant lung diseases caused by the inhalation of respirable mineral dust particles, nearly always in occupational settings. They are generally progressive and incurable, even after removal of the affected worker from further occupational exposure. Most pneumoconiosis develops only after many years of cumulative exposure, but silicosis, beryllium disease, and hard metal disease can be fatal within months to just a few years following very intense exposure. The presence of pneumoconiosis is associated with an increased risk of other diseases. Asbestos-associated diseases include pleural effusions, bronchogenic carcinoma, and malignant mesothelioma. Silicosis is also distinctive in being associated with increased risk for other diseases (e.g., tuberculosis, certain autoimmune diseases, renal disease, and lung cancer [ATS 1997]). Silicosis and coal workers pneumoconiosis (CWP) have been described for centuries and remain major occupational diseases.

As enumerated from death certificate information (Multiple Cause of Death Data, NCHS), overall pneumoconiosis deaths in the U.S. have declined from a peak of over 5000 deaths in 1972 to approximately 3000 in 1992 [NIOSH 1996]. Coal workers pneumoconiosis (CWP) deaths are most numerous and have been declining in recent years. Asbestosis deaths have increased nearly ten-fold over the 1970s and 1980s, but appear to be leveling off in the 1990s. Silicosis deaths declined sharply during the 1970s and early 1980s, but have leveled off at about 300 annually since the mid-1980s [NIOSH 1996]. CWP deaths demonstrate substantial geographic localization to coal mining regions, whereas silicosis deaths are quite widespread; asbestosis deaths are also widespread but tend to be more concentrated in coastal areas associated with shipyard industries.

It is estimated that claims to the Federal Black Lung Benefit Trust Fund for new CWP and related compensation will cost $985 million from 1991 to 2010. For this same period, corresponding state compensation costs will be an estimated $18.2 billion [Page et al. 1997]. The total annual Federal Black Lung Program exceeded $1.7 billion in 1991 [NIOSH 1994]. Similar Federal compensation programs do not exist for other types of pneumoconiosis, so national data on compensation costs for all pneumoconioses are not readily available.

Primary prevention is mainly through control of occupational exposures to dusts that cause pneumoconiosis. With respect to CWP, the Federal Coal Mine Health and Safety Act of 1969 established respirable dust exposure limits and requirements to monitor worker exposures in coal mining. Effectiveness of prevention efforts are reflected in decreasing CWP deaths over the

past two decades (see above), as well as in clearly reduced prevalence of CWP among working underground coal miners [Althouse et al. 1998]. Nevertheless, new cases still occur. Among underground coal miners examined between 1990 and 1995 who had no work experience prior to establishment of the current Federal coal mine dust standard, approximately 2.2 percent had radiographic evidence of CWP, and some even had evidence of progressive massive fibrosis (PMF), the most severe and disabling form of CWP [Althouse et al. 1998]. Recent estimates of risk indicate that approximately 7 out of 1,000 U.S. coal miners will develop PMF after 40 years of working in mines with dust concentrations equivalent to the current permissible exposure limit (PEL) of 2 mg/m^3 [NIOSH 1995]. Changing technology in coal extraction (longwall mining) has been associated with increased dust generation in U.S. mines. Improvements in environmental control technology have not kept pace with advances in production technology [USDOL 1996]. For the year 1993-1994, approximately 6 percent of 32,362 Mine Safety and Health Administration (MSHA) inspector samples for coal mine dust (surface and underground mines) were in excess of the PEL [NIOSH 1996]. Approximately 10 percent of 61,697 coal mine dust samples collected by MSHA inspectors for underground coal occupations from 1988 to 1992, exceeded PEL. The percent of samples in excess of PEL ranged from 22 to 42 percent for those occupations specifically associated with longwall mining [NIOSH 1995]. In 1996, 96,000 miners were employed in U.S. underground and surface coal mines in approximately 800 underground and 1,350 surface mines [MSHA 1998].

With respect to silicosis, PELs have been established for occupational exposure to respirable crystalline silica dust. However, a downward trend in silicosis deaths has markedly slowed or ceased (see above) and new cases of silicosis, including cases of rapidly fatal acute silicosis in relatively young individuals, continue to occur [CDC 1998]. For the years 1985-1994, approximately 15 percent of MSHA inspector samples and 21 percent of OSHA inspector samples for silica were in excess of permissible occupational exposure levels [NIOSH 1996]. It is estimated that more than 1 million U.S. workers are exposed to crystalline silica, and that 100,000 workers are exposed in high-risk occupations [USDOL and NIOSH 1997].

With respect to asbestosis, PELs have been established for occupational exposure to asbestos. In addition, asbestos use has declined sharply. Nevertheless, potentially hazardous exposure still occurs in manufacturing, mining, and in the maintenance or demolition of buildings with asbestos containing materials. Of 805 Federal inspector samples taken in 1993-1994, 2.5 percent exceeded the PEL [NIOSH 1996]. In addition, due to long latency, new cases continue to be diagnosed as a result of past exposures.

Current national surveillance for pneumoconiosis includes the National Surveillance System for Pneumoconiosis Mortality (NSSPM) which has been developed by NIOSH and is based on NCHS multiple-cause-of-death data files for all U.S. deaths [NIOSH 1996]. Individual identifiers are not available. Occupational histories for pneumoconiosis decedents is limited to "usual" industry and occupation (I/O) descriptions which may not represent the industry and occupation associated with the pneumoconiotic dust exposure. In addition, fewer than half the states report usual industry and occupation information for inclusion into the NCHS mortality

data files. With respect to morbidity, national pneumoconiosis surveillance is limited to the Coal Workers X-ray Surveillance Program (CWXSP), a Federally mandated program administered by NIOSH. This screening program is restricted to underground coal miners and participation is largely voluntary. It has been recommended that this program be extended to include surface coal miners [NIOSH 1995].

The Bureau of Labor Statistics (BLS) conducts an annual survey of a sample of employers who report summary occupational injury and illness data recorded in OSHA 200 logs. While long-latency diseases like the pneumoconioses are notoriously under-reported on OSHA 200 logs (and in the BLS survey), BLS does produce periodic reports relevant to the pneumoconioses (categorized by BLS as "dust diseases of the lungs"). Likewise, MSHA regulations require employer reporting of occupational illness from all sectors of the mining industry; but reports of pneumoconiosis and other diseases with generally long latency have been seriously under-reported.

Occupational diseases, including the pneumoconioses, are reportable in a number of states [Freund et al. 1990]. Both silicosis and asbestosis are reportable in 19 and 18 states, respectively. However, state health departments are actively involved in silicosis surveillance and prevention activities in only a few states. NIOSH has funded silicosis surveillance via the Sentinel Event Notification System for Occupational Risks (SENSOR) program in 7 states [Maxfield et al. 1997]. Only 2 states are currently funded. The SENSOR Evaluation studies have demonstrated the efficacy of public health interventions directed through these programs [CSTE 1996].

Pneumoconiosis prevention is a national priority as stated in Healthy People 2000: National Health Promotion and Disease Prevention Objectives and proposed for Healthy People 2010 [PHS 1991]. In 1996, the Council of State and Territorial Epidemiologists (CSTE) adopted a position statement recommending to CDC that silicosis be reportable to the National Public Health Surveillance System. Both silicosis and CWP are regulatory priorities. OSHA established a national special emphasis program on crystalline silica and designated silica as a priority for comprehensive rulemaking [OSHA 1996]. MSHA initiated the "Eliminate Black Lung Now" program in late 1997 [MSHA 1998]. NIOSH historically and currently maintains a significant commitment to pneumoconiosis prevention and control. Pneumoconiosis, specifically as a disease entity, is not a NORA priority research area, but issues included under other NORA priority research area categories, i.e., Exposure Assessment Methods, Control Technology and Personal Protective Equipment, and Emerging Technologies involve the associated dust hazard.

III. Goals for Surveillance

Local

1. To identify individual cases and clusters of pneumoconiosis.
2. To trigger appropriate prevention and control activities (including occupational safety and health regulations), especially in high risk communities/populations.
3 To assure appropriate prevention and control activities at the local level.

State

1. To identify individual cases and clusters of pneumoconiosis.
2. To trigger appropriate prevention and control activities, especially in high risk communities/populations; to assure appropriate prevention and control activities.
3. To evaluate and assess the effectiveness of state pneumoconiosis prevention activities.
4. To demonstrate the need for pneumoconiosis prevention programs.
5. To describe the burden of pneumoconiosis within the state. Provide feedback to local levels.

National

1. To identify individual cases and clusters of pneumoconiosis.
2. To develop, trigger, and target appropriate prevention and control activities (including occupational safety and health regulations), especially in high-risk communities/populations.
3. To assess the effectiveness of national pneumoconiosis prevention activities and monitor progress towards the Healthy People 2000 (and 2010) pneumoconiosis objective.
4. To describe the national pneumoconiosis burden.
5. To facilitate development of related research activities (e.g., on disease management, co-morbid conditions, intervention and evaluation, surveillance methods).
6. To demonstrate the need for pneumoconiosis prevention programs.
7. To help allocate resources for surveillance and intervention. Provide feedback to state levels.

IV. Proposed Case Definition

A health care professional's diagnosis of pneumoconiosis as ascertained from death certificate listing (ICD-9 codes 500-505), hospital discharge diagnosis (ICD-9 codes 500-505), workers compensation, or physician reporting.

V. Proposed Method of Surveillance (local, state, national)

Local

Minimal Level

Forward case reports to state health department.

Desirable Level

Link surveillance data directly to preventive public health intervention via follow-up of selected

cases/clusters directly or via referral to others (e.g., appropriate State or Federal regulatory agencies or NIOSH). Active follow-back to young cases and clusters of cases should have the highest priority.

State

Minimal Level

Ascertainment of cases through secondary review of state death certificate data for cases with a primary or secondary diagnosis of pneumoconiosis (ICD-9 500, 501, 502, 503, 504, or 505). Collect usual I/O data for all cases of pneumoconiosis deaths in all states. Currently, only 19 states code I/O. Periodic pneumoconiosis surveillance reports summarizing the above should be prepared and disseminated.

Desirable Level

Additionally, a group of selected states should carry out more intensive pneumoconiosis surveillance based on the SENSOR model, including:

A. Ascertainment of cases:
   1. direct reporting of cases to state health department by health care providers and B readers;
   2. secondary review of state death certificate data and hospital discharge data (and, if available, analogous data for outpatient visits) for cases with a primary or secondary diagnosis of pneumoconiosis (ICD-9 500, 501, 502, 503, 504, or 505); and
   3. secondary review of state workers' compensation data for cases.

B. Interviews of reported cases or next of kin to obtain information for case confirmation and case classification.

C. Inspections of selected work sites to obtain information regarding exposure(s) and hazardous work practices.

D. Periodic pneumoconiosis surveillance reports, with data stratified by type of pneumoconiosis and summarized overall.

E. Linking of surveillance data directly to preventive public health intervention, e.g., follow-up of selected cases/clusters directly or via referral to others (e.g., appropriate State or Federal regulatory agencies or NIOSH), implementation of radiographic screening programs among long-term workers in high-risk industries/commodities, or development of hazard surveillance programs.

National

Minimal Level

Mortality associated with specific types of pneumoconiosis and with pneumoconiosis overall

should be analyzed using NCHS multiple-cause-of-death mortality data based on mention of specific types of pneumoconioses (ICD-9 500, 501, 502, 503, 504, or 505) as underlying or as contributory cause of death. Periodic reports should include temporal trends, geographic distribution, and morbidity odds ratio (MOR) or proportionate mortality ratio (PMR) analyses relating to industries/occupations (based on "usual" occupation and industry information available on the NCHS data files for deaths occurring in a subset of states). In addition, pneumoconiosis in active underground coal miners should be assessed by appropriate analyses of data from the Federally-mandated Coal Workers X-Ray Surveillance Program (CWXSP), and Part 50 reports to MSHA and BLS annual survey data should be appropriately analyzed and reported, with attention to severe under-ascertainment of pneumoconiosis in these systems. Finally, OSHA and MSHA sampling data for agents that cause pneumoconiosis should be analyzed to identify industries, occupations, individual workplaces, and geographic regions that appear to be associated with potential increased risk of disease. Periodic pneumoconiosis surveillance reports summarizing the above should be prepared and disseminated.

Desirable Level
In addition to minimal surveillance activities, multi-state aggregation of data from states involved in pneumoconiosis surveillance, with periodic pneumoconiosis surveillance reports on same.

VI. **Information Systems to Collect and Aggregate Data**

Electronic or Web-based reporting from all states using a standardized format such as the existing SENSOR silicosis program or other data system which includes a local collection module (for data collection, data entry validation, and reporting to CDC/NIOSH). Standardized variables will be developed by CSTE and NIOSH. Centralized data aggregation at CDC/NIOSH.

Sources of data include:

1. State pneumoconiosis databases
2. National multiple-cause-of-death files from NCHS, reformatted by NIOSH in the National Surveillance System for Pneumoconiosis Mortality (NSSPM) database
3. The NIOSH Coal Workers X-ray Surveillance Program (CWXSP) database
4. MSHA Part 50 data system
5. BLS Annual Survey of Occupational Injury and Illness data
6. Exposure data from OSHA's Integrated Management Information System (IMIS) and from MSHA's Mine Inspection Data Analysis System (MIDAS)

VII. Partner Organizations/Other Agency Domains

American Lung Association (ALA)
American Public Health Association (APHA)

Association of State and Territorial Health Officials (ASTHO)
Council of State and Territorial Epidemiologists (CSTE)
Department of Health and Human Services (HHS)
Public Health Service (PHS)
Office of Disease Prevention and Health Promotion (ODPHP)
Centers for Disease Control and Prevention (CDC)
National Institute for Occupational Safety and Health (NIOSH)
National Center for Health Statistics (NCHS)
Epidemiology Program Office (EPO)
Department of Labor (DOL)
Bureau of Labor Statistics (BLS)
Environmental Protection Agency (EPA)
Industry Associations
Mine Safety and Health Administration (MSHA)
National Association of County and City Health Officials (NACCHO)
Occupational Safety and Health Administration (OSHA)
Physician Specialty Associations
American Thoracic Society (ATS)
American College of Chest Physicians (ACCP)
American College of Radiology (ACR)
American College of Occupational and Environmental Medicine (ACOEM)
State Labor Departments
State Health Departments

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Profile for Fatal Injuries

I **Condition Under Surveillance**
Fatal Occupational Injuries

II **Background and Justification**
Traumatic occupational fatalities represent an inadequately addressed, preventable public health problem in the United States. Based on data from the Census of Fatal Occupational Injuries (CFOI) surveillance system, 6,112 workers died in 1996 from traumatic injuries sustained in the workplace; on each day, an average of 17 people die from workplace injuries. The rate of fatal injuries from 1990 through 1994 remained fairly stable--4.4 deaths per 100,000 workers. Industries with the highest death rates per 100,000 workers were mining (30.5), agriculture/forestry/fishing (20.5), and construction (15.5) according to CDC (1998). Each of these industrial sectors has a traumatic fatality rate that is at least twice the overall civilian workforce rate. The leading causes of death for all industries are motor vehicles, machinery, homicide, falls, and electrocutions. These categories account for nearly 60 percent of the occupational fatalities each year. It is important to note that violence at work is also an ever-increasing problem. Homicide was the second leading cause (after highway crashes) of work injury fatalities in 1996, accounting for 15 percent of the 6,112 job-related deaths. Almost half of the homicide victims worked in retail establishments, such as grocery stores and eating and drinking establishments. Overall, work-related fatalities resulted in direct and indirect costs of $3.69 billion in 1992 (Leigh et al., 1997).

Healthy People 2000 and Healthy People 2010 (draft) National Health Promotion and Disease Prevention Objectives, Occupational Safety and Health, address deaths from work-related injuries. Fatal work-related injuries should be reduced to no more than 3.6 per 100,000 workers (baseline: 5.1 deaths per 100,000 in 1992-1996).

Current surveillance efforts for fatal occupational injuries include the Census of Fatal Occupational Injuries (CFOI) through the Bureau of Labor Statistics (BLS); the National Traumatic Occupational Fatalities Surveillance System (NTOFS) through the National Institute for Occupational Safety and Health (NIOSH); the National Occupational Mortality Surveillance Systems (NOMS) by NIOSH; and the Fatality Assessment and Control Evaluation (FACE) through NIOSH, which includes both in-house and state-based FACE programs. Other sources of fatality data may include state departments of labor, medical examiners' databases, and workers' compensation claims. While information is gathered about how the fatal injury occurred, current surveillance systems are inadequate to develop specific prevention interventions.

Traumatic occupational injuries were identified as a research priority in the NIOSH National Occupational Research Agenda (NORA). Use of a public health model provides a framework

to target occupational injury research and prevention. Components of this model include: 1) identifying and prioritizing problems (injury surveillance), 2) quantifying and prioritizing risk factors (analytic injury research), 3) identifying existing or developing new strategies to prevent occupational injuries (prevention and control),
4) implementing the most effective injury control measures (communication/dissemination/technology transfer), and 5) monitoring the results of intervention efforts (evaluation). Public health policy and resources must address work-related injury prevention efforts, focusing on those industries and workers at greatest risk. In order to reduce the incidence of fatal occupational injuries, specific information about the interactions of the worker, the work environment, and the work processes is required for a complete epidemiologic study of the problem. Moreover, occupation-specific mortality rates are useful for identifying occupations for which more detailed studies may be indicated (Stroup, Zack, & Wharton, 1994).

III. Goals for Surveillance (Local/State/National)

A. *Local*

Not applicable.

B. *State*

- Identify all fatal occupational injuries;
- Analyze data and evaluate risks to identify where intervention is needed;
- Identify current interventions and populations affected, and gaps in intervention efforts;
- Develop, target, implement, and evaluate intervention programs to prevent mortality;
- Educate local city/town clerks, police, firefighters, and medical examiners to identify work-related fatalities, particularly for motor vehicle and homicide;
- Assure appropriate prevention and control activities; and
- Obtain federal and state funding for fatal occupational injury surveillance and control activities.

C. *National*

- Demonstrate the need for public health intervention programs and resources, and allocate resources;
- Assess the public health impact of mortality events and measure trends;
- Identify high-risk population groups or geographic areas to target interventions and guide analytic studies;
- Monitor effectiveness of prevention and control measures and intervention strategies for fatal occupational injuries;
- Obtain funding for fatal occupational injury surveillance at the state and federal levels;
- Develop hypotheses leading to analytic studies about risk factors for fatal injury and fund such studies;
- Partner with agencies and organizations (public and private) in assessment, policy development, and regulatory activities; and.
- Address the issue of confidentiality so data can be linked.

IV. Proposed Case Definition

All fatal injuries that occur as a result of occupational work/exposure are included. The decedent must have been employed (working for pay, compensation, or profit or in the family business) at the time of the event, engaged in a legal work activity or present at the site of the incident as a job requirement (Bureau of Labor Statistics, 1994). Decedents may also include volunteer workers who are exposed to the same work hazards and perform the same duties or functions as paid workers.

V. Proposed Method of Surveillance (Local/State/National)

A. *Local*: Not Applicable

B. *State*:

Minimal Level

1. All states (either through the state public health agency or state labor department) should collect data on all fatal occupational injuries. This is already being collected and documented through the Census of Fatal Occupational Injuries (CFOI) surveillance program in each state.
2. All states should conduct follow-up of each fatal occupational injury to target prevention actions. The follow-up may include but is not limited to education, on-site investigation, dissemination of information, outreach activities, and/or communication with other agencies. If investigation of all fatalities is not possible, states should prioritize the fatalities for follow-up. Secondary data sources may also provide valuable insight to the fatal event and its prevention. Collaboration and a willingness to share information among state agencies is essential.
3. Fifteen (15) states representing different geographic/regional areas should conduct the Fatality Assessment and Control Evaluation (FACE) program with assistance and support from NIOSH. Special studies may be conducted to target unique populations (e.g., teens, minorities, older adults) or certain industries/work environments (e.g., fishing, logging, motor vehicle, convenience stores). Data and case reports should be disseminated to other states.

Desirable Level

1. All states should conduct the Fatality Assessment and Control Evaluation (FACE) program with assistance from NIOSH. Special studies may be conducted to target unique populations (e.g., teens, minorities, older adults) or certain industries/work environments (e.g., fishing, logging, motor vehicle, convenience stores).
2. Prepare and disseminate widely alerts/reports about prevention of fatal occupational injuries. This may be accompanied by education and/or technical assistance to employers, trade associations, stakeholders, etc.

C. National

Minimal

1. State health departments or state labor departments should pass along data on fatal occupational injuries to NIOSH or the Bureau of Labor Statistics for data aggregation and dissemination. Aggregation will permit assessment of trends, magnitude of the problem, and allow identification of populations at risk; and
2. Coordinate efforts with various agencies, such as Bureau of Labor Statistics, EPA, National Center to Protect Women Rights, etc.

Desirable

1. Assist states in guiding injury investigations and intervention activities for the purpose of risk identification and injury prevention;
2. Assist states with creating and distributing educational and informational materials on preventing fatal occupational injuries; and
3. Work with other agencies to avoid duplication of efforts but allow sharing of data.

D. *Sample or Population-Based/Within States, Among States, Nationally*

Population based data on all fatal occupational injuries should be collected nationally.

C. *Periodic or Continuous Data Collection*

Data collection should be continuous to evaluate trends and interventions.

VI. Information Systems to Collect and Aggregate Data

State public health departments should compile fatal occupational injury surveillance data in a standardized format and send them electronically to CDC/NIOSH. State labor departments should compile fatal occupational injury surveillance data in a standardized format and send them electronically to the Bureau of Labor Statistics. Content of case reports, standardization of variables, and coding systems should be discussed by the Bureau of Labor Statistics (BLS) and NIOSH. These data sets should be linked, with additional links to fatal car crash data, police data, death certificate data, and workers' compensation data.

VII. Partner Organizations/Other Agency Domains

A. *Essential Organizations*

National Institute for Occupational Safety and Health
Department of Labor/OSHA
National Safety Council
Bureau of Labor Statistics
Injury Prevention Research Centers
Council of State and Territorial Epidemiologists

Association of State and Territorial Health Officials
Centers for Disease Control and Prevention
Injury Prevention Programs at the State Public Health Agency

B. *Stakeholders*

Cooperative Extension Service
Emergency Medical Service (EMS)
Industry trade associations and unions
Medical Examiners
National Center for Health Statistics
Police/Fire Personnel
University and company researchers (users of the data)
Workers' Compensation

VIII. Strategic Planning

A. *Implementation*

- Develop comprehensive, multi-source surveillance system of all fatal occupational injuries.
- Standardize core variables and coding format. This must be coordinated between the Bureau of Labor Statistics (CFOI) and the National Institute for Occupational Safety and Health (FACE).
- Determine if other mortality surveillance systems collecting similar data need to be continued, i.e., NTOF.
- Establish Memorandums of Understanding (MOUs) among state and federal agencies participating in fatal occupational injury surveillance regarding data- sharing and other issues of concern.
- Aggregate, interpret, and disseminate data/information on state/regional/national levels to promote prevention actions.
- Integrate some occupational questions into field investigations conducted by others who collect data, such as state police doing homicide investigations or traffic safety personnel doing traffic fatality investigations.
- Use existing networks to build intervention avenues.

B. *Resources*

Most states will require at least 1.0 FTE and support from their management information systems to conduct surveillance. Sources of funding are BLS and NIOSH.

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Profile for Nonfatal Injuries

I **Condition Under Surveillance**
Nonfatal Occupational Injuries

II. **Background and Justification**
Occupational nonfatal injuries represent a significant public health problem in the United States. Based on data from the Bureau of Labor Statistics (BLS), 6.1 million private industry workers were injured in 1995, of which approximately 46 percent resulted in lost workdays (BLS, 1998). The highest injury rates occurred in the meat-packing industry, shipbuilding and repair industry, and the automobile manufacturing industry. All three of these industries reported injury rates approximately 4 times higher than the national of 7.5 injuries per 100 workers. The most common type of injury reported by workers was sprains or strains, which accounted for 43 percent of all lost workday injuries. Most injuries were due to being struck by objects (27.5 percent) or from overexertions by the worker (27.4 percent). The annual burden of all occupational nonfatal injuries is estimated at $142 billion (Leigh et al., 1997). The Healthy People 2000 National Health Promotion and Disease Prevention Objectives has the stated objective of reducing work-related injuries to no more than 6 cases per 100 workers (baseline--7.7 cases per 100 between 1983 and 1987). Traumatic occupational injuries are also a research priority under the National Occupational Research Agenda (NORA) (NIOSH, 1998).

National surveillance efforts for nonfatal occupational injuries include the BLS Annual Survey of Occupational Injuries and Illnesses (ASOII), the National Electronic Injury Surveillance System (NEISS) sponsored by the National Institute for Occupational Safety and Health (NIOSH) through the Consumer Products Safety Commission (CPSC); the National Health Interview Survey (NHIS) conducted by the National Center for Health Statistics (NCHS), and the National Hospital Ambulatory Medical Care Survey (NHAMCS) conducted by NCHS. Additional information on nonfatal injuries in the United States include workers' compensation data, hospital discharge data, trauma registries, and case-specific registries such as burn, spinal cord, head injury, and amputation registries maintained at the State level. Many of these registry-based data sources have not been organized into surveillance systems on a large scale.

III **Goals for Surveillance (Local/State/National)**

A. *Local*

1. Identify nonfatal injury cases locally and support the collection of outcome-specific data (e.g., injury outcome registries).
2. Provide nonfatal injury information to employers and communities at the local level.
3. Assist in the implementation of injury prevention programs at the local level.

B *State*

1. Identify case-specific occupational injuries (e.g., injury outcome registries), conduct broad surveillance for occupational injuries (e.g., hospital discharge surveillance,

workers' compensation) with the State, and conduct surveillance on special populations (e.g., youth, migrant workers, self-employed workers).
2. Demonstrate the need for nonfatal injury intervention programs at the State level and provide support for occupational nonfatal injury surveillance and prevention activities at local level.
3. Analyze data to determine priorities and provide resource for local needs within the State.
4. Develop and monitor effectiveness of intervention programs.
5. Develop analytical studies about nonfatal injury risk factors at the State level.

C. *National*
1. Assess impact of nonfatal injuries nationally and measure trends in incidence of nonfatal injuries.
2. Demonstrate the need for nonfatal injury intervention programs and provide support for occupational nonfatal injury surveillance and prevention activities at State levels.
3. Develop and evaluate interventions for occupational injuries and promote them at the national, State and local levels.
4. Develop analytical studies for nonfatal injury risk factors and at the national level.

IV. Proposed Case Definitions

A. All work-related injuries occurring at or for a business that require medical treatment beyond first aid, result in a half-day or more of restricted activity by the worker, or result in a loss of consciousness (i.e., OSHA reportable injury).
B. Hospital emergency room visits for injuries that are the result of performing work activities.
C. Injuries identified through hospital discharge data sources as the result of performing work activities.
D. Injuries identified through outcome-specific injury registries as the result of performing work activities (eg., spinal cord injuries, head trauma, burns, amputations)
E. Injuries identified through State workers' compensation programs.

V. Proposed Method of Surveillance (Local/State/National)

Minimal Level:

A. *Local*
1. Support existing or new State surveillance of outcome-specific injuries by working with local hospitals, physicians, and related health care providers in the identification and reporting of specific occupational injuries such as burns, amputations, spinal cord injuries, and head trauma, or in identifying cases involving special populations (eg., youth, migrant workers).
2. Work with State to develop local occupational injury profile for their community.

3. Provide assistance to State in the follow-up and investigation of severe occupational injuries identified in their community as requested (selected states only).
4. Provide assistance to State in implementing occupational injury interventions at the local level (selected States only).

B. *State*

1. All States use existing occupational data sources, such as State workers' compensation data, to assess nonfatal injury concerns at the State level.
2. Selected States conduct occupational injury surveillance through the use of registries, medical record surveillance programs (e.g., emergency room data, hospital discharge data), or develop novel surveillance systems for assessing special populations, and do investigations of selected nonfatal injury outcomes.
3. Selected States analyze data to determine trends over time and provide local partners data at the community level.
4. Selected States assist local partners in conducting intervention programs, and collaborate with other State Health departments in implementing interventions found to be effective in preventing occupational injuries.
5. All States develop partnerships with State agencies and other organizations within their State that address or have an interest in occupational injuries.
6. All States work with national partners in promoting effective injury prevention programs.

C. *National*

1. Maintain the ASOII, NEISS, and other ongoing national occupational injury surveillance systems.
2. Receive data from selected States on outcome-specific, special population, and broad-based medical record occupational injury surveillance systems to supplement existing national surveillance efforts.
3. Analyze and disseminate surveillance results at the national level, including State and regional data where possible, and provide results to State and local partners.
4. Provide assistance to State programs in conducting surveillance.
5. Evaluate interventions and provide results for use by State and local partners.

Desirable Level:

A. *Local*

1. Support existing or new State surveillance of outcome-specific injuries by working with local hospitals, physicians, and related health care provides in the identification and reporting of specific occupational injuries such as burns, amputations, spinal cord injuries, and head trauma, or in identifying cases involving special populations (eg., youth, migrant workers).
2. Support State in conducting a national medical record surveillance program by working

with local hospitals and physicians.

3. Work with State to develop local occupational injury profile for their community.
4. Provide assistance to State in the follow-up of severe occupational injuries identified in their community as requested (selected states only).
5 Provide assistance to State in implementing occupational injury interventions at the local level.

B *State*

1. All States use existing data sources, such as State workers' compensation data, to assess nonfatal injury concerns at the State level.
2. All States conduct occupational injury surveillance through the use of registries, medical record surveillance programs (e.g., emergency room data, hospital discharge data), or develop novel surveillance systems for assessing special populations, and do investigations of selected nonfatal injury outcomes.
4. All States analyze data to determine trends over time and provide local partners data at the community level.
5. All States assist local partners in conducting intervention programs found to be effective in reducing occupational injuries.
6. All States develop partnerships with State agencies and other organizations within their State that address or have an interest in occupational injuries.
7. All States work with national partners in promoting effective occupational injury prevention programs.

C *National*

1. Maintain the ASOII, NEISS, and other ongoing national occupational injury surveillance systems.
2. Conduct periodic surveys to collect information on special populations that are not well represented in existing occupational injury surveillance systems.
3. Receive data from selected States on outcome-specific, special populations, and surveillance systems to supplement existing national surveillance efforts.
4. Receive data from all States from broad-based medical record occupational injury surveillance program.
5. Analyze and disseminate surveillance results at the national level, including State and regional data where possible, and provide results to State and local partners.
6. Provide assistance to State programs in conducting surveillance.
7. Evaluate interventions and provide results for use by State and local partners.

VI **Information Systems to Collect and Aggregate Data**

Existing surveillance systems will be conducted in their present form. Local and State health departments should compile injury surveillance data in a standardized format and send them electronically to NIOSH. Content of case records and standardization of variables should be

coordinated between the Bureau of Labor Statistics (BLS), NIOSH, and other relevant Federal partners.

VII. Partner Organizations/Other Agency Domains

A. *Essential Organizations*

Centers for Disease Control and Prevention
- National Institute for Occupational Safety and Health
- National Center for Health Statistics
- National Center for Injury Control and Prevention

Occupational Safety and Health Administration
Bureau of Labor Statistics
Environmental Protection Agency
Mine Safety and Health Administration
Federal Railroad Administration
National Highway Traffic Safety Administration
Consumer Products Safety Commission
International Association of Industrial Accident Boards and Commissions
Council of State and Territorial Epidemiologists
State and Territorial Injury Prevention Directors Association
State and Local Health Departments
National Safety Council
State Departments of Labor and Industry
State Workers' Compensation Boards

B. *Stakeholders*

Injury Prevention Research Centers
Industry trade associations and unions
Public Safety Agencies
Emergency Medical Service (EMS)
Hospital Associations
American Medical Association

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DHHS (NIOSH) Publication No. 98-134.

Profile for Work-Related and Occupational Cardiovascular Diseases

I **Condition Under Surveillance**

Work-Related and Occupational Demographic-Related Cardiovascular Diseases (CVD)

II. **Background and Justification**

Despite a 30-year trend of decline, heart disease remains the leading cause of death in the United States (CDC, 1997). Approximately two-thirds of all deaths coded to this cause of death are specified as ischemic (or coronary) heart disease. Along with age, sex, and race, other strong predictors of heart disease risk are cigarette smoking, high blood pressure, elevated serum cholesterol, physical inactivity, family history of heart disease, obesity, and diabetes (ibid). Areas of current epidemiologic research include the effects of diet, exercise, and the possible protective effect of estrogen therapy for postmenopausal women. The importance of these risk factors varies by age and sex and by the particular type of heart disease (ibid).

Occupational exposures such as job strain and psychosocial stress have been shown to increase cardiovascular disease risk (Fine, 1992, Calvert et. al., 1998, Hanrahan, 1993, Leigh et. al., 1997). Common chemical exposures, such as lead, carbon monoxide, methylene chloride, nitrate esters, fluorocarbons, and halogenated solvents all adversely affect the heart (Leigh et. al, 1997; Fine, 1992; Fine and Rosenstock, 1994). From this research, Leigh and colleagues (1997) have estimated that 5 to10% of all cardiovascular and cerebrovascular disease can be directly attributed to occupational and workplace exposure factors. This translates into an estimated 5,092 to 10,185 deaths annually, and between 41,550 and 87,400 incident cases of morbidity. The costs for mortality are approximately $5.8 billion, or 29.4% of total financial burden for fatal occupational disease.

Although the fatality, illness, and cost burdens are great, cardiovascular disease is not specifically mentioned as a priority illness in the National Occupational Research Agenda document (CDC, 1996). However, mention of cardiovascular disease is made in the NORA priority 'Organization of Work'. Work organizational factors should be studied to delineate the impact of demand, control, and strain on the incidence of cardiovascular disease (ibid). The 1998 Council of State and Territorial Epidemiologists (CSTE) Annual Meeting developed position statement #CD6 - Inclusion of cardiovascular disease indicators in the National Public Health Surveillance System (NPHSS) (CSTE, 1998).

Cardiovascular risk factors (such as smoking, alcohol consumption, work, physical and mental stress etc.) distribute into unique patterns by occupation (Fine, 1992, Hanrahan, 1993). There is also evidence that interventions can reduce the reported rate of risk factors for these disorders in specific industries and occupations (Hanrahan, 1993). However, gaps still exist in the level of information about cardiovascular disease and work relatedness. And better information should be developed about the incidence of cardiovascular disease in specific industries or occupations.

III. **Goals for Surveillance (Local/State/National)**

A. *Local*

1. Identify cases and clusters to induce appropriate prevention and control activities.
2. Assess impact of cardiovascular disease and preventable fraction on community health care, employment, and disability services.
3. Inform community health assessment activities.
4. Secure workplace-based intervention resources appropriate to the burden of cardiovascular disease in that locality.
5. Monitor trends.

B. *State*

1. Identify cases and clusters to induce appropriate prevention and control activities.
2. Assess impact of cardiovascular disease and preventable fraction on health care needs, employment, and disability services.
3. Monitor trends.
4. Identify industries/occupations (I/O) with excessive preventable/modifiable cardiovascular disease risk factors and outcomes.
5. Target and evaluate intervention programs. Provide data and information to local health agencies and state businesses.
6. Obtain and allocate limited public health resources for occupation-based cardiovascular disease prevention and control.

C. *National*

1. Identify cases and clusters to stimulate appropriate prevention and control activities.
2. Monitor trends in the occurrence of cardiovascular disease to detect and respond to new hazards or hazards that are increasing in magnitude.
3. Identify industries/occupations with excessive preventable/modifiable cardiovascular disease risk factors and outcomes.
4. Demonstrate magnitude of problems in terms of lost work time, healthcare costs, and disease burden.
5. Facilitate development of research applications (workplace etiology assessment and disease burden).
6. Generate data and information to assist with regulatory development and evaluation.

IV. **Proposed Case Definitions**

A. Disease surveillance

1. *Cardiovascular disease mortality:* cases with an underlying cause of death coded International Classification of Diseases (ICD-9) 390 through 459 in the adult, working population (i.e., aged 16 to 64). By definition, deaths represent instances of preventable mortality.
2. *Cardiovascular disease morbidity:* hospitalizations and physician visits made by working adults with an underlying diagnosis of ICD-9 390 through 459.

B. Hazard surveillance

1. Exposure monitoring (eg., carbon monoxide, methylene chloride, nitrate esters, halogenated solvents, etc).
2. Risk factor monitoring (eg., by industry / occupation, prevalence of cigarette smoking, high blood pressure, hypercholesterolemia, obesity, lack of exercise, etc.).

V. **Proposed Method of Surveillance (Local/State/National)**

Surveillance would initially consist of secondary data analyses, identifying occupations and industries at high risk for 1) cardiovascular disease morbidity and mortality, and 2) industries and occupations with high prevalences of cardiovascular risk factors. Analysis of CFOI at work heart attacks would also be performed to inform the surveillance process. Following this, ongoing analysis of mortality and morbidity trends would be performed by industry and occupation, along with the assessment, by industry and occupation, of exposure and behavioral risk factors. Workplace-based intervention activities, both exposure reduction and behavioral risk factor reduction, would serve as the active or follow-up component of the surveillance activity. Surveillance activities include analysis of program and intervention effectiveness. Evaluation of interventions, through the continuous monitoring of disease and risk factors, closes the loop of the surveillance process. The following summary lists some of the suggested sources of data at the national and state level.

A. *Local*

1. Death Certificate Data
2. Hospitalization Data
3. Physician Visitation Data
4. Behavioral Risk Factor Data
5. Voluntary collaboration among unions, businesses, HMOs, (managed care organizations), and health insurance carriers to evaluate cardiovascular disease data.
6. Information on prevention programs conducted by major employers, unions, managed care organizations, insurance carriers, or industry associations that might include summary data.

B. *State*

1. Death Certificate Data Industry / Occupation (I/O) - PMR / SMR / OR analyses.
2. Hospitalization Data (I/O), including costs.
3. Physician Visitation (Ambulatory Care) Data (I/O), including costs.
4. Collaboration among the state health department, unions, businesses, HMOs (health maintenance organizations), and health insurance carriers to evaluate cardiovascular disease data.
5. BRFSS random telephone survey of adult population, profiling CVD risk factors by occupation and industry.
6. Hazard Surveillance data (OSHA inspections, CO exposure data, CO poisonings).
7. CFOI analysis and evaluation of heart attack at work.
8. Surveillance, intervention / prevention program evaluation analyses.

C. *National*

1. NOMS Death Certificate Data - Industry/Occupation (I/O) - proportional morality ratio (PMR)/standard morality ratio (SMR)/odds ratio (OR) analyses.
2. Hospitalization Data (I/O), including cost estimates.
3. Physician Visitation (Ambulatory Care) Data (I/O), including cost estimates.
4. BRFSS random telephone survey of adult population, profiling CVD risk factors by occupation and industry.
5. Hazard Surveillance data (OSHA inspections, CO exposure data, CO poisonings).
6. Census of Fatal Occupational Illness (CFOI) analysis and evaluation of heart attack at work.
7. NHIS survey of adult population, profiling CVD risk factors by industry and occupation.
8. NHANES survey of adult population, profiling CVD risk factors by industry and occupation.
9. Surveillance, intervention/prevention program evaluation analyses.

Minimal Level:

- PMR/SMR/OR Analysis of NOMS and CFOI death certificate data, with summaries for each (participating) state.
- State specific surveillance of behavioral risk factor prevalence, by industry and occupation groups.
- Select states conduct active surveillance, generating rates of specific CVD conditions, complete risk factor prevalence, and disease rates by industry and occupation. Describe magnitude of specific conditions with greater accuracy using multiple, existing information systems.

Active surveillance systems should include continued interaction and feedback with both the reporters (e.g., physicians, hospitals, managed care organizations) and the affected population (e.g., workers, industry, unions, trade associations).
Implementation of interventions in selected locations based on the identification of hazards through surveillance, and application of known or new strategies to prevent cardiovascular disease.
Basic evaluation of surveillance process, and intervention effectiveness.

Desirable Level (In addition to the Minimal Level above)

- SMR / OR Analysis of hospital discharge, physician visit data by industry and occupation.
- All states conduct active surveillance, generating rates of specific CVD conditions, complete risk factor prevalence, and disease rates by industry and occupation. Describe magnitude of specific conditions with greater accuracy using multiple, existing information systems. States also perform analyses of the preventable fraction of disease.
- Integration of state level data at national level. National analysis to confirm suspected hazards, contributing factors, and assess interventions.
- Targeting specific regions for intervention based on prevalence of high-risk industries/occupations.
- National program of intervention effectiveness research and evaluation.

Information Systems to Collect and Aggregate Data

Existing data systems can serve as the basis for data collection. These include, death certificates (and the national program of data aggregation performed by NCHS), and the HIPA Act legislation establishing the electronic transaction standards for all hospital and physician contacts. Behavioral risk factor data are collected by the BRFSS, NHIS, and the NHANES surveys. These data systems may be shared from the local to the national level using the world wide web (www) to form the basis for data collection and aggregation.

Partner Organizations/Other Agency Domains

A. *Essential Organizations*

Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
National Center for Health Statistics
National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP)
Division of Adult and Community Health (DACH)
National Institute of Health
Health Care Financing Office
National Association for Public Health Statistics and Information Systems (NAPHSIS)
BLS / CFOI Program
National Heart, Lung, and Blood Institute
State Health Departments

B. *Stakeholders*

Labor unions
Insurance Carriers
Industry Representatives
Hospitals / Clinics
Physicians
Managed Health Care Organizations

VIII. Strategic Planning Questions

Cardiovascular disease represents a substantial public health burden, yet the occupational component (i.e., direct exposures) represents a small proportion of cases. CVD prevention resources are enormous when compared to the amount spent on occupational health. How can we successfully tap into the larger fund of CVD prevention resources to improve occupational cardiovascular disease surveillance? What is the role of case follow-up activities given the magnitude of the problem? Given the controversial nature of the work-relatedness of cardiovascular disease (especially stress factors), what types surveillance systems will be acceptable? How do we get better collaboration among stakeholders and partner organizations? How do we integrate the tremendous amount of NHLBI research related to cardiovascular disease with occupational CVD surveillance (especially interventions)?

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