

FINAL PROGRESS REPORT

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LIST OF ABBREVIATIONS

ABLES	Adult Blood Lead Epidemiology and Surveillance
BLS	Bureau of Labor Statistics
BRFSS	Behavioral Risk Factor Surveillance System
CDC	Centers for Disease Control and Prevention
CFOI	Census of Fatal Occupational Injuries
CO	Carbon monoxide
CSTE	Council of State and Territorial Epidemiologists
CVD	Cardiovascular disease
CVHI	Cardiovascular Health Initiative
DET	Division of Employment and Training
DHCFP	Division of Health Care Finance and Policy
DIA	Department of Industrial Accidents
DOS	Division of Occupational Safety (Massachusetts Department of Labor)
ED	Emergency Department
EDSCIP	Emergency Department Surveillance and Coordinated Injury Prevention System
eLCOSH	Electronic Library of Construction Occupational Safety and Health
ERC	Educational Research Center
FACE	Fatality Assessment and Control Evaluation
HBO	Hyperbaric oxygen
HCP	Health Care Provider
HDD	Hospital Discharge Data
HSPH	Harvard School of Public Health
MASSCHIP	Massachusetts Community Health Information Profile
MassCOSH	Massachusetts Coalition for Occupational Safety and Health
M-BIRS	Massachusetts Burn Injury Reporting System
MDPH	Massachusetts Department of Public Health
MNA	Massachusetts Nurses Association
MSD	Musculoskeletal disorders
NECOEM	New England College of Occupational and Environmental Medicine
NIOSH	National Institute for Occupational Safety and Health
OEM	Occupational/environmental medicine
OHI	Occupational health indicators
OHSP	Occupational Health Surveillance Program
OIIC	Occupational Injury and Illness Classification
OSHA	Occupational Safety and Health Administration
PCC	Poison Control Center
SENSOR	Sentinel Event Notification System for Occupational Risk
SIC	Standard Industrial Classification
SOII	Survey of Occupational Injuries and Illnesses
U Mass	University of Massachusetts
WC	Workers' compensation

ABSTRACT

Work-related injuries and illnesses are a significant public health problem in the United States, imposing substantial human and economic costs. Surveillance of work-related illnesses, injuries, and hazards is essential to target, design, and evaluate prevention efforts and to establish research priorities. Surveillance is needed at the state as well as the national levels. State occupational health surveillance programs are few and limited in scope, typically focusing on a few specific health conditions. In a comprehensive national surveillance system, most states would have basic core capacity to carry out surveillance of multiple occupational conditions. What constitutes a “core state program” has not been well established.

Since the mid-1980s, the Massachusetts Department of Public Health (MDPH) has established surveillance systems for selected occupational health conditions and has conducted a wide range of intervention activities to address identified occupational health and safety concerns in the Commonwealth. The MDPH Occupational Health Surveillance Program (OHSP) has also worked closely with other public health programs to integrate occupational health into mainstream health practice. This Cooperative Agreement (7/2001-6/2006) enabled MDPH-OHSP to build on this experience and to develop a Core Occupational Health Surveillance Program that could serve as a model for other states. The proposed activities were based on the assumption that a core program should have the capacity to conduct both case-based and population-based surveillance and working relationships with a wide range of intervention partners. Specific aims of the project fell into four major categories as follows: **Sentinel Event Surveillance:** 1) refine the list of high priority occupational health conditions that require immediate response and should be placed under sentinel case surveillance; 2) develop surveillance protocols for these conditions and implement surveillance; 3) evaluate the prevention impact of sentinel event surveillance activities and revise the model as indicated; **Population-based Surveillance:** 4) describe existing population-based sources of data on health conditions, hazards and populations-at-risk (denominator data) that may be used for occupational health surveillance at the state and local levels; 5) conduct analyses of priority data sets, and prepare and disseminate surveillance reports; 6) assess the utility of these population-based approaches to surveillance and propose a schedule of population-based activities; **Intervention and Prevention:** 7) continue and expand working relationships with prevention partners to promote the use of surveillance data for public health action; 8) develop mechanisms to improve dissemination of surveillance findings; **Regional Collaboration:** 9) work with other states in the Northeast to obtain their input in defining core surveillance functions and to promote development of state occupational health surveillance capacity; and 10) produce a set of written surveillance tools that can be used/adapted by other states to build core surveillance programs.

MDPH-OHSP successfully implemented surveillance of serious work-related carbon monoxide poisoning and serious work-related burns. While the numbers of cases identified were few, surveillance led to interventions to address life threatening hazards and established a capacity to respond to other serious events. A compendium of data sources for occupational health surveillance was developed and analyses of priority data sets, including hospital discharge data, emergency department data, and lead registry data, were carried out. Streamlined approaches for routine use of these data sets were developed. For the first time, MDPH-OHSP accessed the statewide database of all

Workers' Compensation indemnity claims; approaches to cleaning and coding this administrative database to allow its use for occupational health surveillance were developed and information on several targeted conditions was generated. Routine use of this database for broad-based surveillance was beyond scope of what could be accomplished with Core Program resources.

MDPH-OHSP played a leading role in working with other states and NIOSH to develop a set of recommended state Occupational Health Indicators (OHI) now being implemented in a number of states. MDPH-OHSP also worked closely with hospitals and health care workers to develop a new statewide surveillance system for sharps injuries to hospital workers, the only system of its kind in the country. The discretionary nature of Core funding proved key in enabling MDPH-OHSP to build this system and to engage in the OHI development process.

Working relationships with government and private sector partners were also continued and enhanced. A 25-member community OHSP Advisory Board met regularly to advise the program, and a new "research committee links" group was established to both promote academic research response to local community needs and facilitate student projects at MDPH. A number of collaborative activities grew out of this effort. MDPH-OHSP also became a practicum site for occupational and environmental medicine residents at the Harvard School of Public Health. These strengthened relationships with the local academic community expanded the capacity of the Core Program, while providing students experience in applied public health. MDPH-OHSP engaged in a number of successful collaborations with other MDPH programs, integrating occupational health into the ongoing work of the Department. In addition, MDPH-OHSP facilitated continued communication and collaboration among states in the Northeast.

Overall, this project strengthened the state's capacity to identify and address occupational health concerns and provided the basis for a continuing Expanded Occupational Health Surveillance Program in Massachusetts. It also generated a number of approaches and tools that can be adapted by other states. Lessons learned informed Massachusetts' input to both NIOSH and the Council of State and Territorial Epidemiologists (CSTE) regarding the core elements of successful state programs.

HIGHLIGHTS

In July, 2001, the Massachusetts Department of Public Health-Occupational Health Surveillance Program (MDPH-OHSP) entered into a four-year Cooperative Agreement with NIOSH to develop a model state Core Occupational Health Surveillance Program. A one-year no cost extension allowed us to continue work on this project through June, 2006. Major accomplishments during this five-year project period are highlighted below.

Sentinel case surveillance of serious occupational health conditions

- Identified timely (flow basis) data sources for serious occupational burns and carbon monoxide poisonings; developed surveillance case definitions and protocols, and implemented a limited level of surveillance.
- Referred select cases to other agencies for follow-up, leading to worksite interventions to abate serious hazards.

- Developed a poster (available in English, Portuguese, and Spanish) on first aid for burns in restaurants disseminated broadly through the Massachusetts Restaurant Association and Massachusetts Health Officers Association.

Population-based surveillance

- Completed and published a compendium of state data sources for occupational health surveillance.
- Identified priority data sets and target conditions, and conducted analyses of these data sets:
 - Developed methods and completed a surveillance study of hospitalizations for work-related conditions (1996-2000). State report and journal article published. Second article submitted.
 - Developed methods and completed a surveillance study of emergency department visits for work-related conditions (2002). State report published.
 - Develop standard analytic methods, programming language, and programmed templates to produce annual summary tables on work-related hospitalizations and emergency department visits on an annual basis.
 - Prepared and disseminated a surveillance report on occupational lead poisoning in Massachusetts (1996-2001). The new short format for this document has become a template for subsequent surveillance reports.
 - For the first time, negotiated access to the full database of Workers' Compensation indemnity claims; developed approaches to cleaning and coding this administrative dataset to allow its use for surveillance, and generated data on select conditions.
- Played a leadership role in the development of state Occupational Health Indicators and generated 2000 and 2001 indicator data for Massachusetts that is included in national OHI reports and the in MDPH electronic public health information system.
- Collaborated with hospitals and health care worker organizations to develop a new statewide surveillance system for sharps injuries to Massachusetts hospital workers; collected data from all acute care hospitals annually starting in 2002, and prepared and disseminated annual surveillance reports.

Intervention and Prevention Partnerships

- Established a Research Community Links Group to foster academic research relevant to local occupational health needs and promote student projects at MDPH-OHSP:
 - Became a practicum site for residents in occupational and environmental medicine at the Harvard School of Public Health;
 - 14 residency rotations and 8 internships at MDPH-OHSP were successfully completed.
- Participated in intradepartmental activities to integrate occupational health into mainstream public health practice. Examples of success are: inclusion of work-related stress in the state cardiovascular health strategic plan; and inclusion of data on work-related conditions integrated in state reports on fire-related burns, teen injuries, asthma, and traumatic brain injuries.
- Developed and disseminated a resource guide on occupational health information and services in Massachusetts, and revised the MDPH-OHSP website.
- Expanded the OHSP Advisory Board, which continued to meet three times annually.
- Maintained active working relationships with other government agencies, including OSHA regional and area offices, the Bureau of Labor Statistics Region I, the

Massachusetts Departments of Labor, Industrial Accidents and Employment and Training and the Office of the Attorney General.

- Established a new state Advisory Committee on Needlestick Injury Prevention; provided technical assistance to hospitals on an ongoing basis and collaborated with the Massachusetts Hospital Association in holding an annual meeting of hospitals to share needlestick injury surveillance and prevention strategies.

Regional Collaboration

- Co-hosted annual meetings of occupational health surveillance programs in the Northeastern states to share surveillance methods, tools, and experiences
- Maintained listserv for ongoing communication among Northeastern states.
- Completed a regional surveillance project on occupational lead poisoning in five Northeastern states.

TRANSLATION OF FINDINGS

In a comprehensive national occupational health system, most states would have basic core capacity to carry out surveillance of occupational injuries and illnesses to promote state and local prevention efforts. This Cooperative Agreement allowed MDPH-OHSP to develop a model state Core Occupational Health Surveillance Program. A number of important lessons were learned that can inform the development of core programs in other states.

- It was feasible to implement case-based surveillance of several types of serious occupational health events using available data sources. While the numbers of sentinel cases identified were few, surveillance led to worksite interventions to abate serious hazards. Legislative or regulatory authority to access personal and employer identifiers for identified cases was essential as were working relationships and referral agreements with agencies in a position to intervene. Referrals were most successful when relevant standards addressing identified hazards were in place.
- The process of building systems for sentinel surveillance of targeted serious occupational health conditions (serious work-related carbon-monoxide poisoning and burns) fostered a broader state public health capacity for response to other serious sentinel occupational health events as well. With limited resources, surveillance of a variety of different health endpoints that are readily ascertained, as opposed to more extensive surveillance of single conditions, should be considered.
- Hospital data (both inpatient and emergency department data) was found to be an important adjunct to the data available from the Massachusetts Survey of Occupational Injury and Illnesses (SOII.) These hospital data sets are large and flexible, and contain detailed diagnostic and demographic information, including race and ethnicity information not available in traditional occupational health data sources. The statewide coverage of the hospital data sets allows for tracking trends over time and across regions of the state for common and less common occupational conditions. Because these data sets include information about all hospital treated injuries and illnesses, they allow examination of the contribution

of occupational injury and illness to the overall disease and injury burden in the state and facilitate inclusion of occupational information in standard public health data reports. While there was a substantial learning curve in first time use of the data, once methods for analysis have been established and well documented, they can be applied efficiently in subsequent years.

- The process of generating Occupational Health Indicators (OHIs) facilitated access to several new state data sources and served as an important teaching tool that increased program capacity to use existing numerator and denominator data sets for occupational health surveillance. The state OHIs are a ready source of state occupational health information that can be useful in responding to requests from the public, the media and other public health programs.
- Efforts to use the state Workers' Compensation database of indemnity claims for routine surveillance underscored the need for development of automated approaches for coding employer and injury information. Linkage with the state database of employers was moderately successful for assigning industry codes and text searches were moderately successful for coding injury events. However, both methods left many claims uncoded. In large administrative databases where there is a heavy burden of information coding, focusing analyses by industry, injury, or cause of injury can lessen coding burdens and provide a more efficient approach to extracting useful information.
- Stronger links with local academic partners enhanced the capacity of the state-based surveillance program, facilitated student training opportunities in applied public health practice and resulted in new research collaborations.
- The discretionary nature of Core Program funding was instrumental in enabling the MDPH to take advantage of the opportunity to develop a new surveillance system in response to increased local concern about sharps injuries among hospital workers. Initial and ongoing input from data providers and users (hospital and hospital workers organizations) has been key in developing and maintaining this system.
- There were numerous opportunities to integrate efforts to address occupational health concerns into the ongoing work on other public health programs. Given limited Core Program resources, it is necessary to be strategic in choosing opportunities consistent with occupational health program goals, expertise of staff, and interest of community partners.
- Communication among occupational health surveillance programs within the Northeast region provided valuable opportunities for sharing surveillance methods and tools and for staff development. However, collection and analysis of regional data required allocation of additional staff resources specifically for this purpose and cannot be readily incorporated into ongoing Core program activities.

Lessons learned have informed the ongoing work of the MDPH-OHSP and have been shared with other states through a variety of venues, including regional and national meetings, written reports, the revised OHSP-website, and in response to technical assistance requests from individual states. They have also served as a basis for input to

NIOSH strategic surveillance planning, and CSTE's development of recommendations regarding essential elements of state-based occupational health programs.

RELEVANCE AND IMPACT

Work-related injuries and illnesses are a significant public health problem in Massachusetts as they are elsewhere in the United States. Each year in the Commonwealth, approximately 70 workers are fatally injured at work, four of every hundred workers sustain work-related injuries, and an undetermined number experience chronic disease as a result of exposure to health hazards at work. Surveillance systems that provide information about the magnitude and distribution of work-related injuries and illnesses and the circumstances in which they occur are essential to target and evaluate prevention efforts and to inform future research. Surveillance conducted by states is critical to fill gaps in national surveillance and to promote intervention efforts at the state and local levels. This NIOSH-funded project addressed the need to increase capacity of states to carry out surveillance and related prevention activities (CDC, NIOSH, 2001b).

The Cooperative Agreement provided the MDPH-OHSP with resources to develop a Core Occupational Health Surveillance Program that could serve as a model for other states. Given the relatively short, five-year project period and broad nature of this work, intermediate measures of increased surveillance capacity are looked to in assessing program impact. MDPH-OHSP developed a successful and efficient model for surveillance of serious occupational health events linked to interventions in worksites to address potentially life threatening hazards. MDPH-OHSP also obtained ongoing access to several important, previously inaccessible occupational health surveillance data sources and generated a number of new surveillance methods and tools that can be adapted by other states. These included the Occupational Health Indicators that are now required by NIOSH of state-based surveillance programs and being produced by multiple states. The model for surveillance of sharps injuries among hospital workers developed under this Cooperative Agreement is currently being applied in the Massachusetts home health care industry and is generating data requested by stakeholders across the country. New collaborations with other public health programs and academia have raised the profile of occupational health within public health in Massachusetts and leveraged additional resources to address occupational health concerns. New interagency partnerships have also strengthened the infrastructure to improve occupational health and safety in Massachusetts. This experience has been shared both regionally and nationally. State-based surveillance and prevention activities initiated under this Cooperative Agreement continue, and Massachusetts continues to serve as a resource for other states seeking to build occupational health surveillance programs.

SCIENTIFIC REPORT

Background

Work-related injuries and illnesses are a significant public health problem in the United States, imposing substantial human and economic costs. These injuries and illnesses are largely preventable. Surveillance is the cornerstone of public health practice on which to build effective prevention programs (IOM 1999). Surveillance systems that provide information about the magnitude and distribution of work-related injuries and illnesses,

and the circumstances in which they occur are essential to target, design, and evaluate prevention efforts and to identify problems that require further research.

Surveillance is needed at both the state and national levels. National data are needed to set national research and prevention priorities and to monitor nationwide progress in protecting worker safety and health. State-specific concerns, however, can be obscured in national statistics. For example, whereas nationally motor vehicle crashes and homicides lead all other cause of fatal work injuries, in Massachusetts falls from elevations are the leading cause of death. State data are therefore essential for setting state prevention priorities and in evaluating the impact of state prevention policies and programs. State level data can characterize the statewide magnitude of health and safety problems and identify not only the industries and occupations, but also the specific workplaces within the state where interventions to protect workers are most needed. State and local surveillance data can also distinguish populations of workers at high risk who merit special attention. Most important is the ability of state programs to actively link surveillance findings with intervention at the work site and in the community. Building occupational health surveillance capacity in state health agencies also provides an invaluable opportunity to integrate occupational health into main stream public health practice.

States also have a crucial role to play in national surveillance. With access to unique state data sources, epidemiologic capacity, and the ability to conduct timely case follow-up activities to collect in-depth information, states can provide essential information to fill gaps in occupational health surveillance at the national level.

In a comprehensive national occupational health system, most states would have basic core capacity to carry out surveillance of occupational injuries, illnesses, and hazards to promote state and local prevention efforts (NIOSH-CSTE, 2001). In March, 2000, when funding for Core State-based Surveillance was announced by NIOSH, state occupational health surveillance programs were few and limited in scope, typically focusing on a few specific health conditions. The broad objective of the funding announcement was to strengthen state-based occupational health surveillance towards the ultimate goal of increasing the level of prevention activity in the states. NIOSH called for the development of "model state systems for surveillance of multiple occupational health conditions that have high potential for implementation in other states."

Aims of the Cooperative Agreement

Prior to the commencement of this Cooperative Agreement in July 2001, the Massachusetts Department of Public Health's (MDPH) Occupational Health Surveillance Program (OHSP), with NIOSH support, had established surveillance systems for selected occupational health conditions and had conducted a wide range of intervention activities to address identified occupational health and safety problems in the Commonwealth. OHSP had also worked closely with colleagues in other public health domains to integrate occupational health into mainstream public health practice. Under this Cooperative Agreement, MDPH-OHSP proposed to build on this experience to develop, implement, and evaluate a Core Occupational Health Surveillance Program that could serve as a model for other states. MDPH-OHSP set out to establish a model Core Program with the following key components:

- **Sentinel event surveillance:** The capacity to use both new and existing data sources to identify and conduct follow-up of priority occupational health conditions that require immediate public health response.
- **Population-based surveillance:** The capacity to utilize existing state data sets and surveys to monitor patterns of occupational illnesses, injuries, hazards, and interventions in the state in order to target and evaluate prevention efforts.
- **Intervention and prevention:** The capacity to intervene to reduce identified health and safety risks both directly and through established working relationships with prevention partners at the state and local levels.

In addition, MDPH-OHSP proposed to work with states in the Northeast to obtain their input in developing the Core Program and to assess the feasibility of implementing the model program more broadly. MDPH-OHSP also proposed to continue its efforts to integrate occupational health into mainstream public health using the existing public health infrastructure to leverage the resources available for occupational health practice.

The specific aims of the project were:

Sentinel Event Surveillance

- **Aim 1.** Refine the list of high priority occupational health conditions that require immediate public health response and should be placed under sentinel case surveillance, and develop surveillance case definitions for these conditions as needed.
- **Aim 2.** Develop protocols for case ascertainment and follow-up of high priority occupational health conditions and implement surveillance in Massachusetts.
- **Aim 3.** Evaluate prevention impact (e.g. numbers of cases identified, hazards identified, hazards remediated) of sentinel event surveillance activities, and revise the model Core program as indicated.

Population-based Surveillance

- **Aim 4.** Identify and describe existing population-based data sources on occupational health conditions, occupational hazards, and the worker populations-at-risk (denominator data) that may be used for occupational health surveillance at the state and local levels.
- **Aim 5.** Establish priorities for Core population-based surveillance activities based on data sets, health events and/or target populations; conduct analyses and disseminate surveillance reports. *(Massachusetts identified data sets that are available in multiple states as priorities for analysis in the four-year project period. These included Workers' Compensation data, Bureau of Labor Statistics (BLS) Survey data, hospital-based data, and death certificates. Two populations were also identified as state-specific priorities: health care workers and minority workers.)*

- **Aim 6.** Assess the relative utility of these different population-based approaches to surveillance, and propose a schedule of core population-based surveillance functions that can be adapted by other states.

Intervention and Prevention

- **Aim 7.** Enhance working relationships with prevention partners in order to promote the use of surveillance findings for public health action at the state and local levels.
- **Aim 8.** Develop mechanisms to improve dissemination and use of surveillance findings, including but not limited to integration of occupational health findings in reports/information systems that cross public health disciplines, and use of the internet.

Regional Collaboration

- **Aim 9.** Work with other states in the Northeast to obtain their input in defining core occupational health surveillance activities that can be implemented in other states, and to promote the development of state occupational health surveillance capacity.
- **Aim 10.** Produce a set of written surveillance tools that can be adapted and used by other states working to build core programs.

MDPH-OHSP sought to develop a model program that would be flexible enough to identify and respond to new problems and to be adapted by other states to respond to state-specific priorities. As a guidepost throughout the project, OHSP staff repeatedly returned to the question, "What would we tell a state health agency with little or no occupational health experience to do?"

Accomplishments, Challenges, and Lessons Learned

In July 2001, MDPH-OHSP entered into a four-year Cooperative Agreement with NIOSH to develop a model state Core Occupational Health Surveillance Program. A one-year no cost extension enabled us to continue work on this project through June 30, 2006. This section summarizes work carried out under this cooperative agreement during this five year period. The section is organized in four broad categories: sentinel event surveillance, population-based surveillance, intervention and prevention, and regional collaboration. In each category, accomplishments of the Massachusetts Core Program are summarized, challenges in meeting aims are identified, and implications for future state-based surveillance activities are discussed.

Sentinel Event Surveillance

The premise in proposing a core set of sentinel event surveillance activities is that there are certain high priority occupational health events or conditions that demand an immediate public health response (urgent sentinel health events). Just as every case of tuberculosis should be followed-up by an communicable disease practitioner to prevent spread of disease, there are occupational health events that should be tracked and followed-up to assure that the hazards involved are controlled. A state health department should have the capacity to identify and respond to such events. Whereas the state

occupational health surveillance program may not have the resources to intervene in worksites, it should have the working relationships in place with those in position to take action.

Key factors to be considered in developing this list of priority conditions for sentinel surveillance are seriousness of the condition, availability of timely data sources, and amenability to intervention. OHSP initially identified four priority occupational health conditions for core sentinel event surveillance in Massachusetts: 1) elevated blood lead levels (BLLs) $\geq 40 \mu\text{g/dL}$ in adults; 2) fatal occupational injuries; 3) symptomatic cases of pesticide-related illness and injury; and 4) occupational carbon monoxide (CO) poisoning. At the outset of the Core Program, case-based surveillance systems were in place for both elevated blood lead levels and fatal occupational injuries in the Commonwealth. Massachusetts participates in the Adult Blood Lead Epidemiology and Surveillance (ABLES) program, conducting case follow-up of all cases with blood lead levels greater than $40 \mu\text{g/dL}$.¹ OHSP also conducts the Census of Fatal Occupational Injuries and participates in the NIOSH sponsored Fatality Assessment and Control Evaluation (FACE) program, which conducts in-depth research oriented investigations of targeted occupational fatalities. OHSP therefore chose to focus Core Program resources on developing new, case-based surveillance systems for work-related carbon monoxide and pesticide poisonings, both of which are reportable conditions in Massachusetts (105 CMR 300). In Year 1, based on the review of data sources and input from the OHSP Advisory Board and other stakeholders, serious work-related burns were added to the list of urgent sentinel health events to be placed under surveillance.

Surveillance of serious work-related carbon monoxide poisoning

OHSP chose to focus on the most serious cases of occupational CO poisoning and identified hyperbaric oxygen (HBO) chambers as a potential source of timely information about these cases. (Fatal cases of work-related CO poisoning are captured and followed-up through the Massachusetts CFOI and FACE programs and included in the sentinel CO case data file.) As an initial step, OHSP identified and contacted all hospital-based and several private HBO therapy centers in Massachusetts. Private HBO therapy centers were dedicated to hyperbaric treatment of injury and disease and found not to be a source of information about work-related CO cases. OHSP proceeded to negotiate reporting protocols with the two hospital-based HBO chambers (Massachusetts General and Baystate Hospital), and surveillance of hyperbarically treated CO poisoning due to exposure at work was implemented in January 2002. (Clusters of cases identified through the media were also followed-up.) Given the small number of cases reported each year, it took several years to develop case follow-up protocols on the basis of experience.

Key in developing case follow-up protocols was the decision to refer all cases for which employer information is available immediately for worksite investigation without contacting the case. Names of employers, but not patients, are provided to OSHA; cases involving public sector workers, who are not covered under OSHA in Massachusetts, are either investigated by OHSP or are referred to the Division of Occupational Safety in the Department of Labor or to the MDPH Bureau of Environmental Health Assessment based on the location and circumstances of the case. This contrasts with protocols for other less

¹ As of this writing the Massachusetts Occupational Lead Registry now conducts follow-up of all cases with blood lead levels of $25 \mu\text{g/dL}$ or greater.

urgent conditions reported to OHSP, where the affected worker is contacted prior to any referral or contact with employers.

To assess the prevention impact of sentinel surveillance activities, information from the intervention was tracked including the type of intervention, whether OHSP involvement led to work-site follow-up that may not have otherwise occurred (e.g. did OSHA or another agency have knowledge of case prior to referral), what enforcement actions were taken, or what evidence was found that the hazard has been abated. Feedback from referral agencies (predominately OSHA) was obtained from all referrals and entered into the case file, and OHSP met with OSHA Region I staff annually to review all referrals. A proposed effort to update a previous formal memorandum of understanding with OSHA regarding referrals was abandoned in light of OSHA's shift in focus to Alliances.

Between January 2002 and June 30, 2006, 12 incidents involving 32 workers were reported. Five cases were referred to OSHA (three resulting in citations). OSHA had already received notification about three additional cases. OHSP conducted two onsite inspections, and in one case the employee, contacted directly, refused to provide information about the employer.

Sentinel surveillance staff also worked with OHSP epidemiologists to explore the use of other less-timely state data sources, including emergency department data and death records, to document the extent of work-related CO poisoning in the state. Staff reviewed emergency department (ED) data from 1999-2001 from a pilot ED reporting system (EDSCIP) involving 12 Massachusetts hospitals to identify cases aged 14 years or older with a diagnostic code 989 AND either "yes" to injured at work, or worker's compensation listed as the expected payer. In addition, we reviewed the chief complaint field. We found eight cases (1999), 20 cases (2000) and four cases (2001) for a total of 32 cases over the three year period. Among the 32 cases identified, 20 (62%) had the words carbon monoxide or CO in the chief complaint field. Among the 12 that did not identify CO, reported symptoms included anxiety, shortness of breath, head pain, burning throat, vomiting, diaphoresis, dizziness, or flu-like symptoms. Occasionally, the chief complaint included exposure information (e.g. exposure to exhaust fumes). Extrapolating from the data for the 12 EDSCIP hospitals to all EDs (n=80) in Massachusetts, it is estimated that between 160-180 cases occurred statewide during this time period. (OHSP now uses the new statewide database of all ED visits as well as statewide hospitalization data to routinely generate the number of hospital treated CO cases on an annual basis. See population-based activities below.) OHSP also reviewed death certificate data to identify CO related deaths between 1994 and 1998 that occurred at industrial areas. While the query yielded 11 more fatalities than the number of work-related CO deaths captured through the Massachusetts CFI program, all of these were coded as suicide.

Surveillance of serious work-related burns

In Year 1, OHSP efforts to characterize sources of population-based data for occupational health surveillance (Aim 4), led to the identification of the Massachusetts Burn Injury Reporting System (M-BIRS) as a potential source for sentinel case (as well as population-based) surveillance of serious work-related burns. The Massachusetts Department of Fire Services (DFS) maintains M-BIRS for purposes of arson investigation and burn prevention. State law requires all burn injuries extending over 5% or more of a person's body surface area to be reported by treating hospitals to DFS (MGL Chapter 112, Section

12A), and MDPH has statutory access to the burn injury reports submitted to DFS by hospitals. Burn injuries are reported to M-BIRS by fax within 24 hours of the incident and include personal identifiers as well as the location of the occurrence and indication of whether the injury occurred at work. Reports include the victim's home address but no telephone number.

As a first step OHSP reviewed summary M-BIRS data and found that in the 2001 and 2002, respectively, 14% (n=49) and 11% (n=42) of all reported burn injuries occurred at work. Over a quarter of the work-related burn injuries were caused by explosions. In Year 2, OHSP met with DFS and negotiated a data sharing agreement whereby M-BIRS staff immediately fax all reported work-related burns to OHSP on a flow basis. Case ascertainment was implemented on a pilot basis for six months during which time OHSP worked to develop case follow-up protocols. We reviewed case reports to assess the information available in these documents, and met with the MDPH legal department to address patient confidentiality issues, particularly in light of recent HIPAA requirements that might impact our ability to conduct case follow-up. We also met with Region I OSHA staff who expressed interest in referrals of burn cases for which there are relevant OSHA standards (burns due to explosions, electricity, or chemicals). As with CO, the decision was made to refer cases due to these hazards immediately to OSHA for worksite follow-up without prior contact with the injured workers.

Sentinel surveillance of work-related burns covering more than 5% of the body reported by hospitals was fully implemented in 2003. Since that time, work-related cases have been faxed on a flow basis, and annual summaries have been compiled and disseminated in the M-BIRS annual report. In each of the four years (2003-2006), 47 to 53 work-related burn injuries were reported, accounting for 12-14% of all reported burn injuries (all ages) from the 42 to 51 reporting hospitals. Work-related cases tended to be male, young adults. Scalds were the leading cause of work-related burns, as was true for all burn injuries. Explosions and electrical burns accounted for proportionately more of the work-related burns than non-work-related burns reported to M-BIRS during this time period.

Starting in September 2003, OHSP implemented referrals to OSHA of high priority burn injury incidents, including electrical, explosion, and chemical burns. (We may also refer other cases when it appears there have been violations of OSHA standards.) From inception to the end of 2006, 24 incidents were referred to OSHA for which they had no previous notice (including one in New Hampshire). In at least five additional cases, OSHA was already involved in investigating referred incidents, based on information from other sources. The referrals did not always result in citations, but the three area offices welcomed the timely referrals and found the inspections important in targeting inspections to hazardous exposures.

In four incidents during 2003-2004, OHSP referred cases involving burn injuries among restaurant workers to local boards of health. While the health officers welcomed the referrals, they were unfamiliar with occupational incidents and did not effectively explore the causes of the injuries. It was decided to discontinue referrals to these agencies.

Collaboration with DFS has led to incorporation of a regular section in their annual M-BIRS report about work-related burn injuries. OHSP is responsible for coding the industry of employment for each case that has sufficient information and preparing a summary of the work-related findings.

In 2003, OHSP sentinel event surveillance staff collaborated with the OHSP teen injury surveillance project and DFS in developing a poster on first aid for burns in restaurants. Available in English, Portuguese, and Spanish, the poster has been distributed statewide through the Massachusetts Restaurant Association and the Massachusetts Health Officers' Association. In Year 5 (no cost extension period) sentinel staff also assisted Massachusetts FACE in investigating burn related deaths due to use of highly flammable wood floor finishing materials and in the development of a hazard alert on these chemicals (available in English and Vietnamese).

OHSP had also proposed a population-based report on work-related burns using data from CFOI, hospitalization, and outpatient data. Data on work-related burns due to fires in these data sets were analyzed and findings integrated in a MDPH report on fire-related burn injuries completed in 2005 (See Publications List: MDPH, 2005a). Inpatient data on work-related burns was also compared to the M-BIRS data for 2000. While differences in case definition precluded exact comparison, findings indicated underreporting to M-BIRS (60 cases in HDD, 50 in M-BIRS). Data on hospitalized burns by facility was shared with M-BIRS and used to by them in conducting outreach to specific hospitals to encourage reporting. A more extensive population-based report on work-related burn injuries using the "injury triangle" approach is in progress as part of OHSP's ongoing Expanded Occupational Health Surveillance Program.

Surveillance of work-related pesticide poisoning

OHSP chose to use the existing NIOSH surveillance case definition for pesticide related illness and injury and to focus on the Massachusetts Regional Poison Control Center (PCC), located at Children's Hospital in Boston, as a source for case ascertainment. In Year 1, we met with the PCC medical director and other PCC staff together with a representative of the MDPH Injury Control Program, which provides funding for the PCC, and a representative of NIOSH. The director of the PCC was resistant to sharing data with MDPH given concerns about discouraging callers and data sharing provisions in the contract between MDPH and the PCC. The contract, which governs funding and operation of the PCC, specified that the PCC will only release aggregate data to MDPH. Although the PCC considers its callers patients, MDPH lawyers determined that the PCC is not considered a mandated reporter covered by the Massachusetts disease/injury reporting regulations (105 CMR 300).

OHSP proceeded to work with the MDPH legal department and the MDPH Injury Control Program that oversees the PCC to rewrite the contract, as well as the Pesticide Board and the Bureau of Environmental Health Assessment within MDPH to gauge their interest and perspective about pesticide poisonings in Massachusetts. A revised contract that allows the PCC to provide individual data to MDPH went into effect in July, 2004. At that time, OHSP made the decision not to pursue sentinel surveillance of pesticide poisoning, given that it was the last year of the four-year Core cooperative agreement. Notably, data obtained from the American Association of Poison Control Centers as part of the ongoing occupational health indicator project (see below) indicates that approximately 25-30 cases of work-related pesticide associated poisonings in Massachusetts are reported to the Regional PCC annually (2000-2003). Sentinel surveillance of pesticide related poisoning remains on the OHSP agenda to address in the future.

Key surveillance lessons

Although the number of cases of serious CO poisoning and burns reported to OHSP each year was small, these cases were serious, and referrals for worksite follow-up led to steps to abate serious hazards in a number of worksites. We believe that this approach serves as a model for core sentinel surveillance that can be implemented by other states, and we are currently continuing these surveillance systems as part of Fundamental activities within our ongoing Expanded Occupational Health Surveillance Program.

Our experience underscores the importance of having legal authority in place to access personal and employer identifiers necessary to conduct case follow-up. Also, resources to conduct worksite follow-up must be available either in-house or in other agencies. Intervention partners must be willing to accept referrals and have useful tools such as OSHA standards to effect change. For example, we had much more success in promoting meaningful worksite investigations of burns due to explosions, electricity, and chemicals for which there are relevant OSHA standards, than of scald burns in restaurants for which few specific standards apply. We also found that a simple surveillance case definition for CO based on one data source, i.e. hyperbaric oxygen chambers, rather than detailed clinical case information, was feasible and effective for identifying sentinel cases of serious CO poisoning.

The development of follow-up protocols for serious events prompted OHSP to review our existing case follow-up activities and more formally characterize the issues that need to be considered in referring cases for worksite follow-up to regulatory agencies. (See Chart 1 below.) This framework, which has been presented to and well-received by OSHA Region I, the New England College of Occupational and Environmental Medicine, and at the June 2004 annual CSTE meeting, has proved useful and we are continuing to use it in referring serious cases to intervention partners. To our knowledge, referral of serious cases immediately without contact with the affected worker has not had negative ramifications on employment status of workers involved.

Notably, we found that we had to resist expanding CO and burn surveillance to include other data sources, as this would have necessitated a labor intensive SENSOR-like approach to case ascertainment and follow-up that was beyond our available resources or resources likely to be available for this purpose in other states. We found that it was practical to focus Core sentinel activities on few but readily identified serious cases of different conditions.

Chart 1. Factors to be considered in referring cases to OSHA for worksite follow-up

- OSHA/agency jurisdiction
- Relevant OSHA standards
- Statutory limitations on data sharing*
- Patient confidentiality
 - Patient names not released without permission**
 - Patient's fear of or resistance to workplace follow-up
- Seriousness of hazard
- Others at risk
- Employer aware of case (serious acute vs. less serious or chronic)
- Safeguarding relationships with reporters

* These vary by data source

** Patient name can not be released without patient permission but employer name can be released depending upon the data source.

While OHSP's focus was on CO and burn surveillance, building the capacity to identify and respond to these events provided a mechanism within MDPH for responding to other sentinel cases as well. These included, for example, cases of mercury poisoning and cyanide exposures that were reported to the Department. The sentinel surveillance system brought greater visibility to OHSP and to occupational health both within and outside of the department, and also served to reinforce our positive working relationship with OSHA Regional and area offices. It was, and continues to be, an important and gratifying example of linking surveillance with action at the local level.

Assessing the ultimate impact of sentinel event surveillance proved to be particularly challenging. The relatively small numbers of cases and sentinel nature of the data as well as the short time frame precluded examination of trends in health outcomes. We ultimately chose to focus on intermediate outcomes, assessing whether we prompted inspections that otherwise might not have taken place, and whether these inspections identified hazards and resulted in issuance of citations or recommendations for improvement. Validation of actual changes made in individual workplaces was beyond scope given the available resources. The continued cooperation of surveillance partners such as the Department of Fire Services, the hyperbaric chambers, and OSHA can also be considered evidence of success in building the infrastructure to improve occupational health in Massachusetts.

Population-based Surveillance

Periodic analysis of existing state illness, injury, and hazard data sets has been identified as a core occupational health surveillance function (NIOSH 2001; NIOSH-CSTE 2001). An initial step in surveillance planning is to identify data sources that can be used for surveillance. An ongoing program task is to assure to the extent possible that occupational health information be included in new data sets. Not all available data sets can or should be analyzed every year or even periodically. It is important therefore to assess the relative utility of these different approaches in promoting prevention efforts at the state and local levels and to use this information to set priorities for conducting population-based surveillance activities over time.

OHSP proposed to expand on our existing inventory of state surveillance sources and make this available electronically so that it could be used as a template by other states. We also proposed to carry out a set of population-based surveillance studies utilizing a variety of different data sources, to assess the relative utility of these different population-based approaches to surveillance, and to propose a schedule of Core population-based surveillance functions that could be adapted by other states. In addition, OHSP identified two priority populations to consider in implementing population-based surveillance: health care workers and minority workers.

Based on the premise that an occupational health surveillance program should also have capacity to go beyond existing data sources and conduct periodic surveys in response to local priorities, OHSP also proposed to conduct a survey of licensed acute care facilities to obtain information about occupational health surveillance practices.

Inventory of surveillance data sources

OHSP expanded the Massachusetts inventory of state data sources that can be used for occupational health surveillance at the state and local levels. A May 2004 version of *Occupational Health Information in Massachusetts: A Compendium of Data Sources That Can Provide Information About Occupational Illnesses, Injuries, and Hazardous Exposures in Massachusetts* (See list of publications, MDPH, 2004a) was posted on the OHSP website as a resource for researchers in Massachusetts and public health practitioners in other states. This compendium was also submitted for the record at the December 2003 meeting of the National Advisory Committee on Occupational Safety and Health. It was provided as a list of state data sources that can be used to inform OSHA activities.

The compendium contains descriptions of 17 major numerator data sources maintained by MDPH and other agencies. Initial plans to include information on denominator data sources in the compendium as well were put on hold as OHSP shifted population-based surveillance resources to developing and documenting the state occupational health indicators (see below). A number of denominator data sources for state-based surveillance are described within the NIOSH-CSTE indicator documents that have been prepared collectively by states (See list of Publications: CSTE, 2004; CSTE, 2005).

Inclusion of occupational health information in existing data sources

During the project period, OHSP staff also played an active role in advocating for inclusion of work-related information in several state population-based data sources under development. Occupational information (injury-at-work and patient's occupation) will be included in the new statewide Trauma Registry and discussions continue regarding a proposed statewide database of ambulance runs. We also took steps to explore inclusion of occupational information (injury at work or activity at time of injury and employer name) in several existing state data sets (hospital discharge data and emergency department data) and involved OHSP advisory members in the process. These discussions are ongoing and have been expanded recently to address electronic medical records.

A significant and related issue concerns the ability to code employment information that might be included in large public health data sets. OHSP has examined alternative approaches to automated coding of employer name as part of our analysis of Workers' Compensation data (see below). We also piloted the NIOSH automated industry and occupation coding program (SOIC) on industry and occupation data collection by the Behavioral Risk Factor Surveillance System (BRFSS), and found that it did not perform well. This was largely because the data were not collected in a consistent fashion by the survey staff, underscoring the need to educate survey staff about collection of occupation and industry information and to explore use of pick lists to improve data collection. SOIC was also applied to the Cancer Registry data using a modified approach in which common errors and misspellings in the industry and occupation text fields were corrected and standardized and then coded by SOIC. SOIC assigned meaningful industry codes to about 39% of records plus an additional 7% of records that were correctly coded as "not working." The remainder of records had industry information stated as 'Unknown' (44%) or industry information was not codable by SOIC (10%). SOIC assigned meaningful occupation codes to about 42% of records plus an additional 7% of records that were correctly coded as "not working." The remainder of

records had occupation information stated as 'Unknown' (36%) or industry information was not codable by SOIC (15%).

In conjunction with the ongoing OHSP work-related asthma surveillance project, Core project staff also explored use of the statewide BRFSS to collect information on work-related health concerns. This effort has been very successful resulting in two peer reviewed publications. (See list of Publications: Breton, et al, 2006; Flattery, et al, 2006). It has also been very well received by State BRFSS program and work-related questions regarding injury and use of Workers' Compensation have been included in the FY 07 BRFSS as part of the ongoing Fundamental surveillance activities. Use of a pick list for collecting industry information is being piloted in Massachusetts as part of this effort.

Data analysis and surveillance reports

OHSP completed a number of population-based surveillance studies during the project period. While several of the specific activities initially proposed (e.g. analysis of BLS data on musculoskeletal disorders) were not completed, a number of additional activities were carried out in response to emerging state priorities and opportunities. The discretionary nature of the Core funding was critical in enabling us to take advantage of these opportunities.

In-patient Hospitalizations for Hospital Work-Related Injuries and Illnesses in Massachusetts, 1996-2000.

The Massachusetts Statewide Hospital Discharge Dataset (HDD) was initiated in 1980 and includes data from all Massachusetts acute care hospitals. These hospitals are required to submit merged case mix and charge data, which includes patient socio-demographic information, general encounter information, financial information and diagnosis and procedure information. Data are submitted to the Massachusetts Division of Health Care Finance and Policy (DHCFP) and contain over 700,000 patient discharges per year. MDPH has a data use agreement with DHCFP and access to the HDD data set. As part of the Core project, OHSP staff worked to modify the data use agreement to address proposed analyses carried out by OHSP.

The original plan to examine HDD for 1999 was expanded to include data for multiple years. Core Program staff together with a visiting scholar from Korea completed an analysis of HDD for the period of 1996 through 2000. We developed an approach for routine analysis of these data as well as methods for addressing repeat hospitalizations for the same condition. Findings were presented to the OHSP Advisory Board and at the Annual CSTE Meeting in June, 2005. A final report was disseminated in Massachusetts and to other states and is available on the OHSP website (See list of Publications: MDPH, 2005b). A journal article summarizing these findings has been submitted to the journal *Injury Prevention*.

This analysis led to another more focused study in which we examined patterns of hospitalization for work-related conditions by race and ethnicity. Findings were published in a special edition of *Monthly Labor Review* focused on special populations. (See list of Publications: Hunt et al, 2005).

Emergency Department Visits for Work-Related Injuries and Illnesses in Massachusetts, 2002

In fiscal year 2002, DHCFP implemented new regulations requiring hospitals to provide case mix and charge data for all emergency department visits. Like the HDD, the new statewide ED database includes patient socio-demographic information, general encounter information, financial information and diagnosis and procedural information. Unlike the HDD, the ED database contains a brief narrative field as well. Over 2 million ED visits are recorded each year. This new data set allowed us to expand our original proposal to examine ED data from a sample of 12 emergency departments.

Again working with our visiting scholar, Core Program staff completed an analysis of statewide ED visits for work-related injuries and illnesses in 2002. As in the analysis of hospitalization data, we developed an approach for addressing repeat ED visits for the same conditions. Findings of this analysis were presented to the OHSP Advisory Board. The final report has been disseminated throughout Massachusetts and to other states and made available on the OHSP website.

Based on this work undertaken during the Core Program, as part of our ongoing Fundamental activities, we are developing methods for efficiently producing summary data from both the ED and HDD data sets on an annual basis. We have developed standard analytic methods, programming language, and programmed templates to produce annual summary tables on work-related hospitalizations and ED visits that are available on the OHSP website (See list of Publications: MDPH, 2007a).

Elevated Blood Lead Levels in Massachusetts, 1996-2001

The Massachusetts Adult Lead Poisoning Registry was established in 1991 and is a collaborative effort of the Massachusetts Division of Occupational Safety (DOS) and OHSP. State regulations require clinical laboratories to report elevated blood lead levels greater than 15 µg/dL to the Registry in the DOS. Registry staff conduct follow-up interviews with workers and physicians, and worksite investigations are conducted as indicated. OHSP provides epidemiologic support to the Registry as resources allow.

Core Program funding enabled OHSP to complete an analysis of Lead Registry data for the period 1996-2001. Earlier lead Registry reports were forty page documents. Based on input from the OHSP Advisory Board, we shifted to a short, user friendly report format. The Lead Registry report, which includes findings on Hispanic workers and a comparison with findings from the previous surveillance period, has been disseminated throughout Massachusetts and nationally and is available on the OHSP website (See list of Publications: MDPH, 2006a) and on eLCOSH. This short report format has subsequently become a template for other OHSP surveillance reports.

An integral component of this Lead Registry activity was to develop standard programming language and data management tools to allow for more efficient and consistent analysis of the Lead Registry data in the future.

In a related activity, a graduate student working at OHSP completed a student project on repeat elevated blood levels over time. Core project staff also worked on a regional project on work-related lead poisoning (described below).

Development of the Massachusetts Sharps Injury Surveillance System

In 2000, the Massachusetts legislature passed “An Act Relative to Needlestick Injury Prevention” (MGL Chapter 111 s. 53D) requiring hospitals to use sharp devices with engineered safety features, and maintain sharps injury logs. The legislation also required licensed hospitals to report all sharps injuries among employees to MDPH on an annual basis, setting the stage for the development of a statewide sharps injury surveillance system. With discretionary funding provided under the Core cooperative agreement, OHSP was able to take the lead in establishing this new surveillance system, which focused on health care workers - one of our priority populations. We conducted the proposed survey of licensed health care facilities regarding their ongoing sharps injury surveillance and prevention activities. Based on findings and input from representatives of hospitals and hospital staff organizations, we developed the surveillance model and user friendly surveillance tools that allowed for collection of standardized data across hospitals. Reporting regulations went into effect in October 2001. Since that time, OHSP has collected sharps injury data annually from all licensed Massachusetts hospitals and prepared annual surveillance reports which have been disseminated to hospitals and hospital workers throughout the state, to stakeholders nationally, and to others on request. These annual reports and data collection tools are available on the OHSP website (See list of Publications: MDPH, 2004b, 2006b, 2007b, 2007c).

The goal of the surveillance system is to generate information that can be used by hospitals, health care workers, and the Department in targeting and evaluating efforts to reduce the incidence of sharps injuries. The system is also intended to facilitate exchange of information about successful prevention strategies among facilities. Surveillance findings have been presented each year at an annual meeting dedicated to sharps injuries organized by OHSP in collaboration with the Massachusetts Hospital Association. Findings have also been presented in a number of other venues, including for example, the annual meeting of the American Public Health Association (2002, 2005, 2006), CDC/National Center for Infectious Disease (2005), annual meeting of the Council of State and Territorial Epidemiologists (2002, 2003, 2005, 2006), and at several NIOSH sponsored meetings addressing surveillance and bloodborne pathogen exposures (2001, 2003, 2006). OHSP also provides technical assistance to hospitals regarding sharps injury surveillance and prevention on an ongoing basis and coordinates the Massachusetts Sharps Injury Prevention Advisory Committee.

The Massachusetts Sharps Injury Surveillance System has served as a model for an ongoing joint OHSP – U Mass Lowell research project implementing surveillance of sharps injuries among home health care workers. Tufts Dental School has also expressed interest in applying this model to sharps injuries among dental students. The development of the system was initially supported by a combination of funding from the Core cooperative agreement, and CDC National Center for Infectious Disease, Division of Health Quality Promotion. Continuation of this surveillance and intervention project is now a key component of OHSP’s ongoing Expanded Occupational Health Surveillance Program, with support from both NIOSH and the state.

Occupational Health Indicators

In our initial Core Program application, OHSP proposed to generate annual counts of mesothelioma cases using the cancer registry data and silicosis cases using death

certificate data. This initial plan expanded into a much larger occupational health indicator project described below.

In 2001-2002, the Occupational Health Surveillance Work Group of the Council of State and Territorial Epidemiologists (CSTE) developed a set of recommended occupational health indicators (OHIs) for use by the states. Core Program funding allowed OHSP staff to play a major role in this process. Dr. Davis, Core Program PI served as co-leader of the multi-state workgroup developing the OHIs and OHSP Core Program staff took the lead in developing five of the 19 indicators. At the April 2002 State-based Occupational Surveillance Consortium meeting, the four participating core states agreed to pilot the OHIs and develop “how to” guidance for other states over the next year. Thus, the indicators became a new Core surveillance initiative that demanded significant allocation of Core Program resources. OHSP compiled surveillance data for all Massachusetts indicators, developed and revised “how to” guidance documents for five indicators, negotiated access to BLS and OSHA data, and oversaw aggregation of indicator data across 13 states. OHSP staff also played a key role in writing the final multi-state indicator report *Putting Data to Work: Indicators from Thirteen Pilot States for 2000* (See list of Publications: CSTE, 2005). This report was disseminated to key stakeholders throughout Massachusetts. In addition, OHSP prepared a state OHI document available through the Massachusetts Community Health Information Profile (MassCHIP), MDPH’s electronic public health information system. Dr. Davis also co-authored a special supplement to the MMWR on the OHIs, published in January 2007 (See list of Publications: Thomsen, et al. 2007). As part of our ongoing Fundamental activities, OHSP is continuing to generate the OHIs annually and to work with CSTE to aggregate data across states and evaluate the indicator process.

Analysis of state-wide Workers’ Compensation data for 2000

OHSP had initially proposed to explore the utility of state Workers’ Compensation data for occupational health surveillance. Specifically, we proposed to prepare a statewide report on musculoskeletal disorders, respiratory disease, and acute trauma, using statewide indemnity claim data. The Core Program played an important role in OHSP’s accessing, for the first time, the entire computerized file of all lost time claims filed with the Massachusetts Department of Industrial Accidents (DIA) for each of four years 2000-2003. Approximately 50,000 claims were filed in each of these years. However, there were significant challenges in carrying out the project as planned. Given concerns about data confidentiality and a mistake in the initial search codes to extract data from the DIA database, there was a several year delay in accessing the data. Once we had obtained the data, we found that it needed extensive cleaning and coding before we could embark on data analysis. Although the database includes Standard Industrial Classification (SIC) codes, we found these were missing for 50% of the establishments (32% of claims). Where they were available, they were at the two-digit level, too broad to allow for meaningful data analysis (2000 data). While injury information was coded according to the now outdated American National Standards Institute System, cause of injury was not.

The coding tasks necessary to complete the report as proposed were beyond the scope of what was feasible as part of the Core Program. We did, however, explore approaches to coding employer and cause of injury information using the 2000 data set. We aimed to develop efficient methods that could be applied to subsequent years of data. A number of steps were carried out:

- We were for the first time able to access the Division of Employment and Training's (DET) electronic database of Massachusetts private sector establishments with more than 4 employees and used these data to code (NAICS, SIC, and establishment size) establishments in the DIA database. Both automated and manual approaches to coding were applied. Approximately 29% of the cases were able to be coded automatically using the DET database. An additional 37% were coded manually by comparison to the DET database.
- A sample of the private sector cases that were not coded using the methods above were coded manually using other commercially available resources. We found that the distribution of industries among these cases was significantly different than for the DET coded cases (Chi-Square test $p < 0.0001$). Proportionately more of the cases coded using commercial sources were employed in Construction, Retail, and Other Services; and proportionately fewer employed in Manufacturing and Health Care. Thus, reliance on the DET file would result in systematic bias in the observed industry distribution, as well as distribution by establishment size.
- An algorithm for coding public sector establishments using narrative text searches and self-reported SIC was developed. Public administration establishments can be identified using SIC, but identification of the broader set of Public sector establishments, which occur in a number of industries², required the use of narrative text searches using specific establishment names. Public sector establishments would ideally be identified using a "type of ownership" variable (public vs. private). Using SIC industry codes without the text search resulted in a significant undercount of Public sector cases. The study was presented at the 2006 CSTE Annual Meeting.
- To validate the accuracy of self-reported SIC for private sector cases, the DIA dataset was matched with the DET dataset by establishment name, city and street address. The accuracy of reported codes was assessed on a two-digit level. From 11,913 claims that contained self reported SIC other than "Unclassifiable" and were matched with private establishments in the DET dataset, SIC was validated for 8,080 (67.8%) claims or 62.3% of establishments.
- Self-reported SIC for public administration claims were validated only for their type of ownership – public or private. Manual review with Reference USA as a source of type of ownership revealed that 90% of establishments that reported SIC within Public administration were confirmed as public sector establishments³. Conclusion: self-reported SIC within Public Administration can be used to code ownership of the establishment as public, but does not allow capturing all public sector establishments in DIA data.
- Narrative information describing incidents was available for 88% of the 53,091 cases in the 2000 file. An algorithm for automated coding of injury/illness cause (based on ICD-9-CM E codes) using narrative incident description was developed. When implemented in SAS, it allowed for coding of 63% of cases with available incident description. Validation of electronically assigned codes remains to be carried out.

² Among 360,427 state and local employees in Massachusetts in 2001, 237,288 (65.8%) were employed by establishments outside of Public Administration sector (Employment and Wages – ES-202).

³ This is a conservative estimate, as only 5% of establishments appeared to be private according to Reference USA and the remaining 5% were not located in this data source.

Several targeted analyses of the available data have also been carried out. We have, for example, been able to use the available datasets to generate counts of carpal tunnel syndrome and amputations required for the occupational health indicators.

OHSP is continuing its work to make it possible to use DIA data for occupational injury surveillance as part of the ongoing Expanded Occupational Health Surveillance Program. We are working to prepare a report on illnesses and injury to public sector workers. We are also working on interagency agreements to institutionalize MDPH access to DIA and DET data on an annual basis.

Analysis of work-related Musculoskeletal Disorders (MSDs) using data from the Annual Survey of Occupational Illnesses and Injuries (SOII)

In Year 2, we initiated a collaborative project with the Region I office of the Bureau of Labor Statistics (BLS) and the Division of Occupational Safety (DOS) to explore the utility of Annual Survey of Occupational Injuries and Illnesses for state based surveillance of priority conditions/populations. We chose to examine MSDs, one of the priority health conditions identified in our initial application. At that time, OSHA had recently revised its definition of MSDs using the Occupational Injury and Illness Classification System (OIICS), and we found that we could not simply use data available on the SOII CD-ROM to obtain MSD data based on this new definition. BLS staff therefore provided us with data for each year 1998-2000 on the numbers and incidence rates of MSDs by SIC codes, body parts, categories of days away from work, and sources of injury/illness, based on the new MSD definition. Following Silverstein et al. (2002), we developed a prevention index to prioritize industries for intervention. This project was placed on hold due to changes in staff coupled with competing project priorities.

Key surveillance lessons

The population-based activities undertaken evolved somewhat differently than initially proposed for a variety of reasons, including issues with accessing Workers' Compensation data and the quality of these data, development of an important new opportunity to establish a sharps injury surveillance system, and the evolution of the multi-state effort to develop occupational health indicators. The discretionary nature of the funding was critical in allowing OHSP to respond to these challenges and opportunities accordingly.

We have found that hospital data (both inpatient and emergency department data) have a number of advantages for occupational health surveillance. These are large, flexible, statewide data sets that include detailed demographic information, including race and ethnicity information not available in the major occupational health data sets, and detailed diagnostic and cause of injury information, as well as information about hospital costs. Because these datasets include information about all hospital treated injuries and illnesses, they allow examination of the contribution of occupational injury and illness to the overall disease and injury burden in the state and facilitate inclusion of occupational information in standard public health data reports. However, these data sets do not contain information about work-relatedness and it is necessary to rely on the designation of Workers' Compensation (WC) as the expected payer as a proxy indicator. There is some evidence that the predictive value of this indicator is high (Sorock, et al, 1993) yet it is well recognized that many workers eligible for WC do not apply for compensation

(Azaroff, et al, 2002) and that the self-employed are not eligible. Findings based on WC as the indicator of work-relatedness must therefore be considered conservative estimates of work-related injuries and illnesses treated in hospitals. Further research regarding barriers to applying for Workers' Compensation is necessary to understand potential biases.

A greater limitation, perhaps, is that these data do not include information about industry or occupation and thus are of limited usefulness in targeting industry or occupation specific prevention efforts. Nevertheless, we feel that they are an important adjunct to the available data from the Survey of Occupational Injury and Illnesses (SOII) which is based on OSHA logs maintained by employers from a sample of establishments and has been found to undercount work-related conditions (Rosenman et al, 2006). The small sample size of the SOII for Massachusetts also precludes detailed analysis of any but the most common conditions and any analysis by region within the state. The statewide coverage of the hospital data sets allows for tracking trends over time and across regions of the state for common and less common occupational conditions. Focused analyses can be used to target more in-depth surveillance and research projects. While there was a substantial learning curve in first time use of the data, once methods for analysis have been established and well documented they can be applied efficiently in subsequent years. Our plan is to use these methods to prepare short, annual data summaries (See list of Publications: MDPH, 2006c) and to periodically conduct more in-depth analyses.

Our experience in conducting analysis of the Lead Registry data underscored the importance of developing standard, well-documented methods and software applications to allow for efficient data analysis in subsequent years. As with the hospital data, short annual summaries with periodic (e.g., five-year) in-depth reports are planned.

Evaluation of the Occupational Health Indicators is ongoing as part of the Expanded Program and is being carried out in collaboration with CSTE. To date, there is consensus among states that generating the indicators is an important teaching tool that increases state capacity to use existing data sets and has helped in many cases to promote new interagency collaborations.

Our experience in attempting to use the statewide Workers' Compensation database suggests that it is a potentially very valuable source of information. However, significant resources are needed to convert this administrative database into one that is useful for routine surveillance. Policy considerations in using the data to target regulatory actions also need to be addressed. As mentioned, OHSP is continuing its efforts to promote use of these data as part of the Expanded Program.

The Massachusetts Sharps Injury Surveillance System is providing previously unavailable information about sharps injuries and is the most comprehensive system of its kind in the country. There were a number of critical lessons learned in developing this system: the importance of getting input from data providers both at the outset and on an ongoing basis; devising an approach that allowed hospitals to meet multiple (OSHA and State) regulatory requirements at once; and development of pick lists and electronic tools for data reporting to standardize data elements and streamline data coding tasks. Close collaboration with the state epidemiologist and the MDPH Division of Health Care Quality in developing this system strengthened the visibility and position of OHSP within MDPH. The working relationships with both health care employers and health care

workers created through this process also provide a foundation for expanding efforts to address additional hazards in the health care sector.

Intervention and Prevention

A core occupational health surveillance program is intended to promote prevention activities at the state and local levels. To be meaningful, surveillance must be actively linked to intervention and prevention efforts. It is essential for core programs to have working relationships with prevention partners. At the outset of this Cooperative Agreement, OHSP had strong working relationships with a variety of agencies, organizations, and academic institutions throughout the state. OHSP proposed to continue and enhance these working relationships and to place increased emphasis on building working relationships with allies within the public health system who are in positions to reach populations of workers whose needs have not been well addressed through conventional approaches to occupational health. In addition, we proposed to establish more formal relationships with academic partners to both extend our core surveillance capacity and also to provide a training ground for future occupational public health practitioners.

OHSP Advisory Board

During the project period, OHSP reconstituted its Advisory Board by renewing appointments and adding several additional members, including a representative from the insurance industry. The 25-member Advisory Board met approximately three times per year throughout the project period. OHSP also maintained its Advisory Board listserv to facilitate communication with and among board members between meetings. Given the variability among state occupational health programs, we did not prepare formal guidelines for setting up advisory boards to be used by other states as proposed in Year 3. However, upon request from other states, we have shared information about how our Advisory Board is structured, its goals, and letters of invitation to prospective members.

Representatives from other government agencies including OSHA, the Department of Industrial Accidents, the Division of Safety, the Attorney General's Office, and the Bureau of Labor Statistics, continued to serve as Ex Officio members of the Advisory Board and OHSP continued to have strong working relationships with these agencies throughout the project period. OHSP met annually with the Region I OSHA Director to review program priorities and interagency referrals and to identify opportunities for collaboration. OHSP staff also maintained regular contact with OSHA Area Directors and with Compliance Assistance Specialists. During the project period, OHSP staff also presented at several regional trainings of OSHA inspectors and Compliance Assistance staff. Since 1991 OHSP has implemented the Census of Fatal Occupational Injuries in Massachusetts and has a solid working relationship with the BLS Region I office.

OHSP also developed stronger working relationships with the Massachusetts Division of Employment and Training (DET) during the project period. As described, for the first time we were able to access DET's electronic database of establishments with SIC and NAICS codes and establishment size information. A formal interagency data sharing agreement that would allow for annual access to these data is under development.

Partnerships with Local Research and Advocacy Groups

OHSP worked with the Massachusetts Coalition for Occupational Safety and Health (MassCOSH) to establish a “Research Community Links” group intended both to facilitate student projects with MassCOSH and OHSP and also to foster academic research projects that address local occupational health needs. This group included representatives from the following academic institutions: University of Massachusetts at Lowell, Harvard School of Public Health, Boston University School of Public Health, the Dana Farber Cancer Institute, and Department of Family Medicine and Community Health, Tufts University School of Medicine. The group met regularly over the project period and established a listserv for ongoing communication.

Growing out of this collaboration, in June 2003 OHSP entered into an agreement with the Occupational/Environmental Medicine (OEM) residency program at Harvard School of Public Health ERC to have residents in the practicum year complete rotations at OHSP. Fourteen residents completed rotations at OHSP during the project period. Each resident spent two to three months in the program. OHSP is continuing this collaboration with OEM as part of the ongoing Expanded Occupational Health Surveillance Program.

A number of additional joint projects evolved out of the Research Community Links group, including: an OHSP, U Mass Lowell, and Boston University collaboration with the Pleural Mesothelioma Research Group at Brigham and Women’s Hospital to document mesothelioma cases (ongoing); collaboration with NIOSH and U Mass Lowell in planning the NORA research meeting on immigrant workers held in Massachusetts in June 2004; and group member collaboration on two environmental/occupational justice grants successfully submitted by group members. OHSP subsequently collaborated with both of these funded projects: the Coalition for a Better Work Environment for Brazilians and the Dorchester Occupational Health Initiative. Group members also developed a standard mechanism and procedure for posting student project descriptions and eight student projects were completed at OHSP during the project period. Project staff presented lectures at various institutions throughout the project period including, for example, annual lectures in the Harvard School of Public Health’s (HSPH) Injury Control Course, presentations in the Boston University School of Public Health’s surveillance course, Tufts occupational and environmental health class, OEM grand rounds, and the surveillance seminar at HSPH.

Throughout the project period, OHSP also participated in a number of events with intervention and prevention partners in Massachusetts. These included, for example, the annual conference of the Massachusetts Thoracic Society (2006), the annual conferences of the New England College of Occupational and Environmental Medicine and Massachusetts Occupational Health Nurses (2001-2006), and the MassCOSH annual town meeting

OHSP updated its *Resource Guide: Occupational Health Resources & Services in Massachusetts* that identifies prevention partners and can be used as a model by other states. This was placed on the OHSP website and disseminated in hard copy to OHSP’s partners, on a flow basis to workers identified through our case based surveillance systems, and in response to requests. We also worked to revise and update our website, www.mass.gov/dph/ohsp, within the confines of the website architecture prescribed for state agencies in the Commonwealth.

Integration of Occupational Health into Mainstream Public Health Practice

Substantial Core Program staff resources were devoted throughout the project period to integrating occupational health into mainstream public health. OHSP staff participated in multiple intradepartmental working groups formed to address different public health problems, advocating for inclusion of occupational health concerns. These groups included the MDPH: Asthma Work Group, Youth and Young Adult Working Group, and Cancer Prevention and Control Committee. We also participated in the HIV/AIDS Dental Working Group, a collaboration of MDPH, the Boston Public Health Commission, and community partners; the Hepatitis C Advisory Committee; an interagency working group to establish a trauma registry committee; a traumatic brain injury task force; and the Massachusetts Cardiovascular Health Initiative (CVHI). CVHI involved MDPH collaboration with over 75 community organizations to develop a statewide 10-year strategic plan to reduce cardiovascular disease (CVD) in the state.

This work resulted in a number of “integration successes,” several examples of which are highlighted below.

- An objective to address occupational stress as a risk factor for CVD was included in the 10-year strategic plan to reduce CVD in the Commonwealth. (To our knowledge, Massachusetts is the only state CVD plan that addresses occupational stress.) This objective and its endorsement by the community partnership provided a basis for academic partners at U Mass Lowell to apply for and receive federal funding to educate the public health community about occupational risk factors for heart disease and prevention strategies.
- The MDPH Director of Adolescent Health presented data on teen occupational injuries at the 2002 annual meeting of Health and Human Services funded state Adolescent Health Coordinators. To our knowledge this is the first time that occupational injuries to youth were addressed in this venue.
- Data on occupational health conditions were included in MDPH documents on a number of public health concerns, including reports on fire related injuries, traumatic brain injuries, youth injuries, and the Massachusetts asthma burden document. Data were also included in the Governors’ report “Vision for Adolescent Health,”
- Employment data and data on occupational health indicators was included in the Massachusetts Community Health Information Profile (MassCHIP), MDPH’s online, public use data system that provides community level health status data for local public health planning.

The development of the Sharps Injury Surveillance System can also be seen as an important integration success as it involved close collaboration between OHSP and several MDPH programs including the Bureau of Health Care Quality, the Bureau of Communicable Disease Control, and the Oral Health program.

Key lessons learned

We have found that the opportunities for integrating occupational health into mainstream public health are many and can effectively extend our reach. Public health colleagues

typically know little about occupational health but are receptive to our input. However, we have also found that these efforts can be very time consuming and can generate additional work that exceeds our resources and in-house expertise. In short, we have learned that it is critical to be strategic in deciding when to say yes to these opportunities and have identified a number of factors to consider in making these decisions:

- Is the activity consistent with OHSP's priorities and objectives?
- Is there potential for legislation/policy action or future resources?
- Is the activity responsive to the interests of the OHSP Advisory Board or other active occupational health stakeholders for whom OHSP can serve as a bridge with the Department?
- Is there potential for building important new relationships?
- Is the effort going somewhere, i.e. is the staff of the effective?
- Does OHSP staff have the in-house technical expertise or relationships with community experts required to be responsive?

(This initial framework was presented to other states at the 2007 CSTE annual meeting.)

Integration remains an essential activity within all components of OHSP's Expanded Program.

Regional Collaboration

States within a given region are likely to have occupational health concerns in common; sharing surveillance information, prevention strategies, and materials can avoid duplication of efforts and maximize use of limited surveillance resources. Less experienced states can learn from more experienced states that face similar problems. MDPH proposed as part of the Cooperative Agreement to continue several regional activities that allow neighboring states in the Northeast to work together. We also felt it was critical to get input from other states in developing the Core Program. As a more experienced state working to develop a model Core program, it was essential to be cognizant of the realities in other states and to embark on activities with high potential for implementation by less well developed surveillance programs.

Each year during the project period, OHSP collaborated with the University of Connecticut Health Center to co-sponsor the annual Northeast Regional Occupational Health Surveillance Conference held in Connecticut. These meetings were attended by approximately 50 representatives from Maine, New Hampshire, Rhode Island, New Jersey and New York, as well as Massachusetts and Connecticut. NIOSH staff also participated. These meetings provided important opportunities to share information and experiences across states. Because these meetings were held within driving distance of all the participating states and it was possible to include junior staff, they also served as an important opportunity for new staff development. At each annual meeting, a session was devoted to the discussion of what should constitute Core or minimal surveillance activities in the states. This helped inform OHSP's work and also served as input to NIOSH in their development of the Surveillance Program Announcement (PAR-04-106, Original release date May 25, 2004). Throughout the project period, OHSP also maintained the Northeast-Occupational Health Surveillance listserv to facilitate communication and sharing of materials among states between the annual meetings.

In the period prior this Cooperative Agreement, the Northeast states had identified a number of potential collaborative surveillance projects that would involve sharing data across states, however, given lack of resources, we had been unable to move forward.

With resources provided by this Cooperative Agreement, we were able to embark on a regional data project combining data on adult lead poisoning from the Northeastern states (MA, ME, NY, CT, NH, RI, NJ). A graduate student from U Mass Lowell was enlisted to assist with this project and subsequently presented findings at the 2004 Northeast meeting and the 2004 CSTE annual meeting. The project revealed several important discrepancies in coding protocols among the states, as well as notable differences across states within the same industries.

During the project period, OHSP was engaged in a number of additional activities to enhance surveillance capacity in the region. We facilitated a NIOSH-run training of state program staff in changes in industry and occupation coding (including the new 2000 Census codes, the 2002 North American Industry Classification System and the Standard Occupational Classification manual). These trainings took place in Hartford, Connecticut and Boston, Massachusetts in June 2004. OHSP staff also participated in a variety of regional training programs and conferences, including, for example, the Maine Occupational Research Agenda (MORA) meetings in May 2003 and 2005, the Asthma Regional Council meetings in 2003-2006, a training session on young worker health and safety in Connecticut (October 2002), and the annual meeting of the Northeast Young Worker Safety Network (March 2003). In a related project, we developed a detailed guide for other states on how to conduct surveillance of work-related injuries to youth. This document available on the OHSP website serves as a model for providing written guidance on conducting surveillance of other occupational health conditions. (See list of Publications: MDPH, 2005c.)

Overall lessons learned in developing a model Core Occupational Health Surveillance Program have informed Massachusetts' input both to NIOSH surveillance planning and to CSTE's recently revised "Guidelines for Minimum and Comprehensive State-Based Public Health Activities in Occupational Safety and Health (currently under review at NIOSH.) Lessons are also reflected in a chapter written by the project PI in *Preventing Occupational Disease and Injury: "Roles of State and Local Departments."* (See list of Publications: Davis, 2005.)

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GENDER, MINORITY AND CHILDREN SUBJECTS

The population-based and sentinel case surveillance activities did not restrict individuals on the basis of age, gender, race or ethnicity. Children, women, and individuals of all races and ethnic groups were included in the surveillance findings to the extent that they were present in the underlying populations of injured and ill workers. Minority workers were also identified as a priority in conducting population-based surveillance activities. Specific findings on minority workers were included where possible in OHSP surveillance reports and were the focus of specific publications on work-related hospitalizations.

MATERIALS AVAILABLE FOR OTHER INVESTIGATORS

In addition to the publications cited above the following materials are available for other investigators:

- SAS programming language for generating reports on hospitalizations and ED visits for work-related injuries and illness.
- Advisory Board materials

Department of Health and Human Services
Final Invention Statement and Certification
(For Grant or Award)

DHHS Grant or Award No.
U01 OH007302

- A.** We hereby certify that, to the best of our knowledge and belief, all inventions are listed below which were conceived and/or first actually reduced to practice during the course of work under the above-referenced DHHS grant or award for the period

7/1/2001 through 6/30/2006
original effective date date of termination

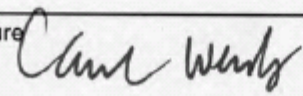
- B. Inventions** (Note: If no inventions have been made under the grant or award, insert the word "**NONE**" under Title below.)

NAME OF INVENTOR	TITLE OF INVENTION	DATE REPORTED TO DHHS
	NONE	
(Use continuation sheet if necessary)		

- C. First Signature** — The person responsible for the grant or award is required to sign (in ink). Sign in the block opposite the applicable type of grant or award.

TYPE OF GRANT OR AWARD	WHO MUST SIGN (title)	SIGNATURE
Research Grant	Principal Investigator Letitia Davis	
Health Services Grant	Director	
Research Career Program Award	Awardee	
All other types (specify):	Responsible Official	

- D. Second Signature** — This block **must** be signed by an official authorized to sign on behalf of the institution.

Title Chief Financial Officer		Name and Mailing Address of Institution MA Department of Public Health 250 Washington Street Boston, MA 02108
Typed Name Carol Weisberg		
Signature 	Date 1/8/07	

1. Federal Agency and Organizational Element a. Which Report is Submitted Centers for Disease Control Public Health Service	2. Federal Grant or Other Identifying Number Assigned By Federal Agency 5 U01 OH007302-04	OMB Approval No. 0348-0039	Page 1	of 1 Pages
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3. Recipient Organization (Name and Complete address, including Zip code) Massachusetts Department of Public Health 250 Washington Street Boston, Ma. 02108	DUNS 878298900
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4. Employee Identification Number 1-04-6002284-B7	5. Recipient Account Number or Identifying Number 4518-0532	6. Final Report ☒ Yes ☐ No	7. Basis ☒ Cash ☐ Accrual
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8. Funding/Grant Period (See instructions) From (Month, Day, Year) 7/1/2001	To (Month, Day, Year) 6/30/2006	9. Period Covered by this Report From (Month, Day, Year) 7/1/2004	To (Month, Day, Year) 6/30/2006
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10. Transactions:	I Previously Reported	II This Period	III Cumulative
a. Total Outlays			\$366,680.82
b. Refunds, rebates, etc.			\$0.00
c. Program income used in accordance with the deduction alternative			\$0.00
d. Net outlays (Line a, less the sum of lines b and c)			\$366,680.82
Recipient's share of net outlays, consisting of:			
e. Third party (ie kind) contributions			\$0.00
f. Other Federal awards authorized to be used to match this award			\$0.00
Program income used in accordance with the matching or cost sharing alternatives			\$0.00
h. All other recipient outlays not shown on lines a-f or g			\$0.00
i. Total recipient share of net outlays (Sum of lines e, f, g and h)			\$0.00
j. Federal share of net outlays (line d less line i)			\$366,680.82
k. Total unliquidated obligation			\$0.00
l. Recipient's share of unliquidated obligations			\$0.00
m. Federal share of unliquidated obligations			\$0.00
n. Total Federal share (sum of lines j and m)			\$366,680.82
o. Total federal funds authorized for this funding period			\$366,681.00
p. Unobligated balance of federal funds (line o minus line n)			\$0.18
Program income, consisting of:			
q. Disbursed program income shown on lines c and/or g above			
r. Disbursed program income using the cost share alternative			\$0.00
s. Undisbursed program income			\$0.00
t. Total program income realized (Sum of lines q, r and s)			\$0.00

11. Indirect Expenses	a. type of rate (Place "X" in appropriate box) ☐ Disproportional ☐ Predetermined ☐ Fixed ☒ Fixed			
	b. Rate 14	c. Base \$197,227.37	d. Total Amount \$27,611.83	e. Federal Share \$27,611.83

12. Remarks: Attach any explanations deemed necessary or information required by Federal sponsoring agency in compliance with governing legislation

13. I certify to the best of my knowledge and belief that this report is correct and complete and that all outlays and unliquidated obligations are for the purposes set forth in the award documents.
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Typed or Printed Name and Title George Trubiano / Deputy Director of Accounting	Telephone (Area code, number and extension) (617) 624-5848
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Signature and Authorized Certifying Official 	Date Report Submitted 6/28/2006
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