



## Medical Surveillance

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Occupational medicine practice focuses on preventing occupational diseases in workers who are exposed to particular chemical, biological, and physical workplace hazards. Medical surveillance is a core preventive clinical service that impacts individuals and groups whose occupation places them at significantly increased risk of a controllable disease.

Physicians provide medical surveillance services in several contexts: performing baseline medical surveillance examination, such as for a worker who is going to be (or already is) exposed to a regulated substance such as lead; as a consultant asked to interpret data from a medical surveillance program to identify trends or patterns and provide recommendations for further investigation or control; or as a medical-legal expert reviewing a case to retrospectively assess causation and the extent to which a worker's occupational disease was caused by or contributed to by a particular hazard.

Millions of workers in the United States alone are regularly exposed to one or more specific chemical or physical hazards that are regulated under the OSHA health standards (29CFR Part 1910.1001-1450). The figures in Table 41-1 do not include workers in mining who may have similar exposures but are not covered under specific Mine Safety and Health Administration (MSHA) health standards, or workers covered by surveillance programs for substances, hazardous occupations, or diseases outside the framework of a specific OSHA standard.

There is no single accepted definition of medical surveillance. NIOSH defines occupational health surveillance as “the tracking of occupational injuries, illnesses, hazards, and exposures.” Federal Occupational Health defines it as “the systematic assessment of employees exposed or potentially exposed to occupational hazards.” The Joint ILO/WHO Committee on Occupational Health defines occupational health surveillance as “a system which includes a functional capacity for data collection, analysis and dissemination linked to occupational health programs.” Some entities differentiate

hazard surveillance from health surveillance—the former done largely by government regulatory agencies focusing on the workplace, the latter focusing on the employee.

### Surveillance Versus Screening

Workplace medical (health) surveillance is commonly conflated with medical screening. In reality, medical screening is a subset of medical surveillance.

Medical screening is the process of early detection and treatment of diseases associated with particular occupations. The focus of medical screening is on the *individual* exposed or at-risk worker. The purpose is to detect increased probability of disease, risk, or early pathophysiologic changes or end-organ damage resulting in clinical manifestations (symptoms or signs). This is accomplished by medical examinations, biological monitoring, and/or other forms of physiological assessment.

Medical surveillance, in contrast, is the process of identifying, quantifying, and removing causative factors that increase the risk of occupational diseases or injuries. Medical surveillance thus includes, but is *not limited to*, medical screening. Surveillance entails compiling and analyzing the health data from these individuals as a group over a period of time. The purpose of medical surveillance is to identify cases of disease; evaluate trends and effectiveness of exposure controls; detect contributory factors that may involve workers (eg, work practices), exposures, or interactive factors; and/or measure the impact of certain interventions such as exposure controls.

As a result of this inherent dichotomy between screening and surveillance, the vital yet underutilized role of information (data) analysis and corrective action often falls to regulatory agencies (see Chapter 42). The distinction is important for clinicians to understand because medical surveillance is intended to be an *active, ongoing* preventive process *inherently linked to corrective or preventive action*. If health and exposure

**Table 41–1.** OSHA health standards. Estimates of workers exposed to Chemical or Physical Hazards.

1910.xxxx	Substance/Hazard	# Workers	Reference(s) and (Year)
95	Noise	30,000,000	OSHA (2009), NIOSH (2009)
120	HazWaste/HazMat	1,758,000	OSHA (1989)
134	Respirator	4,953,568	OSHA (2009), OSHA (1998)
1001	Asbestos	6,389,586	OSHA (1994)
1003	13 carcinogens		
1017	Vinyl chloride		
1018	Arsenic, inorganic	660,000	OSHA (1998)
1025	Lead	2,400,000	ATSDR 2005 (1978), OSHA (1993)
1026	Chromium, hexavalent	558,000	OSHA (2006)
1027	Cadmium	524,816	OSHA (1992)
1028	Benzene		
1029	Coke-oven emissions	6,135	OSHA (1998)
1030	Blood-borne pathogens	5,576,026	OSHA (1991)
1043	Cotton dust		
1044	1,2-Dibromo-3-chloropropane		
1045	Acrylonitrile		
1047	Ethylene oxide		
1048	Formaldehyde	2,156,801	OSHA (1992)
1050	Methylenedianiline	3,836	OSHA (1992)
1051	1,3-Butadiene	9,703	OSHA (1996)
1052	Methylene chloride	237,496	OSHA (1997)
1450	Laboratory chemicals		
132-138	All PPE (including Respirators)	11,731,653	OSHA (1994)

information, such as from medical monitoring, is collected merely to satisfy “compliance” recordkeeping requirements but nothing substantive is done with this information beyond making individual employee health determinations, surveillance efforts in many cases are ultimately ineffective.

## Types of Surveillance

### A. Occupational Diseases

For occupational diseases resulting from exposure to chemical, physical, or biological hazards, the most common form

of surveillance—like most of the OSHA health standards—are *hazard specific*.

Medical surveillance for hazards for which no specific health-based standard exists (eg, silica or mercury, or any substance regulated under MSHA) is often conducted by companies or organizations on a voluntary basis using company-specified requirements. Surveillance can be conducted for workers who have *unknown or variable but potentially significant, nonreproducible exposures* (often not measurable or quantifiable), such as the OSHA Hazardous Waste and Emergency Response Standard. Although noise

is technically considered a “safety” standard, it should be considered a health standard because noise-induced hearing loss is one of the most prevalent occupational diseases in the world. The OSHA standard’s allowable effect (the threshold shift) is set to indicate detection of disease rather than as an indicator of early effects.

Medical surveillance also can target *specific occupations and industries* (eg, spray painters) where multiple hazards or conditions are present. For firefighters, exposures per se cannot be accurately measured or quantified due to the inherent variability of the exposure conditions. In such occupations where a disease endpoint (eg, cancer or certain lung diseases) may be established or suspected, the goal of medical screening is primarily to detect early signs of disease, and surveillance to assess the extent to which the incidence of disease actually occurs. A new area of surveillance concerns nanomaterials, a relatively new industry in which the specific health endpoints are just beginning to be studied.

Similarly, surveillance can be aimed toward a *specific disease or disease class* (eg, lung cancer, asthma, berylliosis, contact dermatitis, cumulative trauma disorders). This approach is seen in selected industries with high-profile hazards who are large enough and compelled (by regulators or unions) to devote the resources needed to collect and analyze data over long periods of time sufficient to assess the risk of occupational disease and efficacy of exposure-control methods.

## B. Occupational Injuries

In the United States, companies are required to record all work-related injuries and acute illnesses (whether occupational diseases or not) and diseases, and report them to federal and state agencies which compile and track them statistically to use for regulatory purposes. Surveillance for acute work injuries (eg, back strains) or classes of accidents (eg, motor vehicle accidents) is conducted in some industries. For certain classes of musculoskeletal disorders such as cumulative trauma, the distinction between “injury” and “disease” may be gray. The approach to injury versus illness surveillance has several key distinctions which are related to their different characteristics and the corresponding different approaches to safety versus health.

For injuries, the term “surveillance” is applicable when injury data are collected and analyzed over time or in groups to identify determinants that contribute to such incidents, and to measure the impact of certain interventions (eg, seat belt use for preventing injuries related to motor vehicle accidents) on injury rates. The data that are typically recorded represent discrete categorical (eg, musculoskeletal strain) or ordinal (eg, lost workdays, fatalities) data. Physicians in clinical practice may benefit from understanding this information, but they are otherwise rarely involved in its collection aside from treating injured

workers and completing workers’ compensation injury claims forms.

## RATIONALE

### Primary Prevention

Primary prevention methods are intended to minimize employee exposure to hazards and risk of injury or occupational disease. Ideally the risk to the worker should be reduced to the point where adverse health effects attributable to that agent do not occur. At the workplace/employer level, this approach includes workplace and job design and practices to minimize or avoid employee exposure to hazards through engineering, administrative, and/or personal protective equipment (PPE) controls, training, and exposure monitoring. For many of OSHA’s health-based standards (eg, lead, asbestos, coke oven emissions), the employer is required to have a compliance plan that addresses these key prevention measures. Worker training is a critically important element of primary prevention. As a part of worker training, the worker is informed of risks and the measures that the employer must undertake to minimize them. The worker is also required to undertake measures to protect his own safety and welfare.

The physician is typically not involved in the design and implementation of primary prevention unless acting as a consultant to the company or a director or employee of the company’s medical, safety, or risk management department. The physician who conducts medical surveillance examinations has the responsibility to determine which employees at baseline (ie, before starting the job involving the exposure) are at increased material risk or susceptibility to disease or injury, and decide whether or not it is safe for the employee to work in the particular industry or job, including the employee’s ability to wear PPE as assigned or intended for the particular job or tasks. This importantly includes protecting individuals with preexisting conditions which place them at increased susceptibility.

### Secondary Prevention

Secondary prevention entails early detection of exposure and/or risk of disease or injury during employment in a particular job. The concept is that if the disease is preventable or reversible, early identification of risk or actual adverse health effects can be achieved by identifying the problem at its earliest stage and to intervene to prevent further “serious” or irreversible disease and disability.

The physician’s role in medical surveillance, particularly as it is specified by OSHA health standards and other countries’ comparable regulations, is focused on secondary prevention through medical surveillance examinations and/or medical monitoring such as biological or physiological monitoring (eg, PFT, radiographs).

## Tertiary prevention

Tertiary prevention occurs after significant overexposure and/or overt injury/illness has already occurred. This is the focus of most aspects of modern clinical medicine, that is, treatment of the disease process.

For many occupational diseases, however, a “cure” is rarely available in lieu of prevention. In theory, if primary and secondary preventive measures by the employer, physician, and employee have been implemented correctly and consistently, this reactive mode of prevention should have a minimal, if nonexistent, role in medical surveillance.

The ultimate form of tertiary prevention in medical surveillance is temporary or permanent removal of an employee from his/her job due to signs or symptoms of early occupational disease, overexposure as reflected by medical, biological or other medical monitoring, and/or industrial hygiene data, or a new or preexisting medical condition that is (or is likely to) be materially impacted as a result of the employee’s occupational exposures.

In practice, regulatory citations and penalties represent the largest single trigger for initiation of tertiary prevention. At the employer level, they necessitate a response to hazards to fix them or prevent further damage after the problem has occurred. Most citations and penalties arise based upon employee complaints about workplace conditions and hazards reported to regulatory agencies. Examples include underreported or contested injuries and illnesses, uncorrected hazards, nonimplemented physician restrictions, or other problems that employees experience or perceive as jeopardizing their health. For certain serious or catastrophic overt injuries and safety hazards that result in major disability or fatalities, there can be significant media attention and regulatory scrutiny which identifies failures and results in corrective actions.

In contrast, occupational diseases—or early indications of increased risk for disease—receive little or no public attention until they are uncovered involving groups of workers with advanced disease. Consequently, by the time some occupational diseases are finally recognized, a reaction to “fix” penalties and intensified regulatory intervention is often “too late” to undo the past damage to those exposed. For the employer, the cost to “repair after it’s too late” is often far more expensive and time consuming than it would have cost to have prevented the problem in the first place. This point underscores the vital importance of the physician’s role to both the worker and the employer in providing medical surveillance to prevent these serious, costly consequences.

## REGULATIONS

### Health-Based Regulations

Health-based regulations such as lead, asbestos, and benzene are primarily **exposure driven** and **performance based**. The regulatory agency (eg, OSHA) sets an allowable exposure level

(the permissible exposure limit, or PEL) for each regulated chemical, physical or biological hazard. This value represents the maximum allowable (airborne) exposure (usually time-weighted average over the course of a shift) to which an employee can safely be exposed, with or without respiratory protection.

Under these Standards, each company or organization must create its own written, facility-specific *compliance plan* that comprehensively addresses and evaluates how it will measure and control exposures to achieve this goal. The compliance plan must be reviewed and reevaluated at regular intervals (at least annually) or when operations change, based upon regular determinations of the results of exposure monitoring and employee health outcomes, that is, “performance.” Certain outcomes may warrant no changes, while others may necessitate further investigation, changes in frequency, and/or content for some employees’ compliance activities, or improvements in exposure controls.

Because work conditions and volume, job duties and tasks, and employees’ health and work practices change over time—sometimes unpredictably, sometimes subtly or without notice—the requirements of health-based compliance programs can be highly complex, “moving targets” (Table 41–2).

### A. OSHA Standards

Some of the OSHA 29CFR1910.1 health standards require medical surveillance and/or biological monitoring or other testing. Only a few specific health standards specify the minimum content for medical histories (including several that contain specific questionnaires), physical examination, individual removal criteria, and certain biological monitoring thresholds for individual workers. The standards otherwise provide the physician with no specific guidance on how medical surveillance examinations should be conducted, or how examination findings or tests should be interpreted (Table 41–3).

**Table 41–2.** Variables which influence health-based compliance risks, needs, and outcomes.

Person (Employee)	Place (Job-Workplace)	Time (Temporal Events)
Age	Job duties & tasks	Hire
Gender	Work volume	Terminate
Education	Equipment	Reassign/transfer
Experience	Work practices	Absent
Fitness	Exposure	Overtime
Medical conditions		
Habits		
Susceptibility		
Behavior		

**Table 41–3.** OSHA 29CFR 1910 subpart Z—toxic and hazardous substances.

1910.xxxx	Substance	Specific Questionnaire	Physical Examination-Organ System Content <sup>a</sup>	Specific Examination Content?	Body Fluid Tests	XR/Physio Tests
1001	Asbestos	Yes	CV, lung, GI	No	None	CXR, PFT
1002	Coal tar pitch	No	None	No	None	None
1003-1016	13 carcinogens	No	None	No	None	None
1017	Vinyl chloride	No	Liver, spleen, kidneys, skin, connective tissue, pulmonary	No	None	None
1018	Arsenic, inorganic	No	Nose, skin	No	None <sup>b</sup>	CXR
1025	Lead	No	Dental, heme, GI, renal, CV, pulm, neuro	No	PbB, ZPP, CBC, UA, BUN/Cr	None
1026	Chromium, hexavalent	No	Skin, resp	No	None	None
1027	Cadmium	No	Renal, CV, resp, heme, repro, MS	No	CdU, CdB, $\beta_2$ M; CBC, UA, BUN/Cr <sup>c</sup>	CXR, PFT
1028	Benzene	No	None	No	CBC <sup>d</sup>	None
1029	Coke oven emissions	No	Skin	No	UA, sputum cytology	CXR, PFT
1030	Bloodborne pathogens	No	None	No	HBV, HIV	None
1043	Cotton dust	Yes	None	No	None	PFT
1044	1,2-Dibromo-3-chloropropane	No	GU	No	None	None
1045	Acrylonitrile	No	Neuro, resp, skin, thyroid	No	Stool for OB	CXR
1047	Ethylene oxide	No	Lung, heme, neuron, repro, eyes, skin	No	CBC	None
1048	Formaldehyde	No	Skin, resp	No	None	PFT
1050	Methylenediamine	No	Skin, liver	No	LFT, UA	None
1051	1,3-Butadiene	Yes	Liver, spleen, CV, skin	No	CBC	None
1052	Methylene chloride	No	Lungs, CV, liver, neuro, skin	No	None	None

<sup>a</sup>Not including heart, lungs for respirator fitness.

<sup>b</sup>Formerly included sputum cytology.

<sup>c</sup>Numeric biological monitoring criteria.

<sup>d</sup>Specifies individual CBC trend analysis but no methods provided.

Medical surveillance is therefore an important component of many health-based compliance requirements. OSHA typically specifies that medical surveillance is required for employees whose exposure to the regulated substance exceeds a level that is called the “action level” (AL), which is arbitrarily set at half (50%) of the PEL with some exceptions. The rationale of the AL is that at this level of exposure, a mechanism is in place to monitor for, detect, and potentially prevent or reverse symptoms or signs

indicative of overexposure or physiological effects of an occupational disease.

## B. MSHA Standards

In contrast to OSHA, MSHA does not have any specific health-based standards (aside from noise, which is regulated as a safety standard). MSHA’s Air Quality and Physical Agents (29CFR Part 58 Subpart D) provision sets exposure

limits for airborne contaminants based on the 1973 ACGIH Threshold Limit Values, which are only occasionally updated by rulemaking. The requirements are to monitor exposures “as frequently as necessary to determine the adequacy of control.” Similarly, each mining company is left to determine the methods of control of employee exposures to airborne contaminants.

With regard to health, MSHA’s health standards for metal and nonmetal mines do not regulate specific substances or hazards. In some instances (eg, lead), federal MSHA has adopted the corresponding OSHA health standard as a *de facto* regulation. Thus, outside of coal mining in the United States, mine workers’ health is not specifically protected by regulations. Mining companies therefore have much greater latitude with regard to the type, content, and scope of medical surveillance programs they operate. MSHA nonetheless has the authority to regulate for these substances in the absence of specific minimum regulatory requirements.

### Impact of Science & Technology

Health-based standards, which are exposure driven and performance based, often do not reflect or keep pace with current scientific knowledge about chronic health risks at levels below permissible limits or methods of medical assessment. In the United States, methods and requirements promulgated by OSHA in 1970s (eg, lead standard) have not been modified in over 30 years, despite advances in scientific understanding of the disease. For example, lead’s chronic health effects are recognized to occur with blood lead levels well under the threshold of 40 ug/dL that OSHA uses to increase the frequency of medical surveillance, while the ZPP level—once the only available indirect method of biological monitoring prior to the commercial advent of the blood lead level—remains a requirement even in spite of its limited utility and high rate of false positives. Another example is the arsenic standard, which continues to require a periodic chest radiograph presumably to screen for lung cancer, while no requirement for a widely available biological monitoring test, the urine arsenic, is mandated.

### KEY ELEMENTS

All medical surveillance programs share several common ideal (theoretical) characteristics, some or all of which may occur in practice.

#### Ongoing

Surveillance programs in a company are continuously operated for as long as the hazard exists, at least to the extent that regulations require. A surveillance program’s scope should expand or contract if the hazard, risk, and/or population changes. The risk of experiencing an adverse effect from a hazard (whether it be risk of an injury or ongoing exposure

to a toxicant) may vary in frequency, intensity, duration, depending on employee-specific and work-specific factors as well as less well-defined variables.

#### Systematic

In theory, surveillance should be conducted using a planned approach that is regularly performed according to objectively defined methods. Ideally it entails much more than individual medical evaluations (exams, tests) which are conducted for purposes of satisfying regulatory requirements. The information should be utilized for the purposes of periodically assessing its preventive efficacy, and updating the plan accordingly.

In practice, many medical surveillance programs including those promulgated by OSHA consist largely of medical monitoring, with no provisions or methods for aggregate or temporal analysis of data.

#### Collection

Significant amounts of complex, time-dependent, inter-related data are collected from medical surveillance programs over time. The minimum required content of information that should be collected is specified in only a few health-based OSHA standards. In other countries, the specifications may be more extensive. For a given occupational hazard, the amount, formatting, and detail of surveillance program (eg, lead, asbestos) data can vary significantly from physician to physician, company to company (and even within a company), and industry to industry.

As employees are hired, transferred, terminated, absent, or reassigned, their program requirements and schedules must be modified accordingly. Employees exposed to the same hazard are not necessarily equally susceptible to the same occupational disease. Each employee’s required medical examination may have a particular outcome which requires individualized or group attention, variable frequencies of follow-up, or other unpredictable requirements. For example, employees who have certain medical conditions or habits (eg, smoking) that place them at increased susceptibility to adverse health effects, and may warrant additional monitoring, restrictions, or increased frequency of monitoring.

OSHA requires that certain minimum information be provided to the physician. In performing medical surveillance, however, the physician should not be a passive recipient of information. The physician should inquire about employee and employer information—prior history and any changes that have occurred in an interval—and determine to what extent this information could have significant bearing on the employee’s health. The physician must recognize when and to what extent information is missing, incomplete, or uncertain, but should render an opinion nonetheless based upon the available information. All of this must be done in a relatively brief span of time.

Most OSHA standards require employers to maintain employee-specific data for *at least 30 years* after the date of the employee's termination. Each of these may entail different methods, approaches, and requirements.

## Analysis

Information acquired in a surveillance program is intended to be used, at a minimum, to assess individual workers' health, susceptibility, and impacts related to an occupational exposure. More broadly, the true purpose of surveillance is to evaluate the collective and temporal risks, outcomes, and trends. Regulatory agencies typically provide guidance (as regulatory requirements) for individuals, but rarely (if ever) for aggregate analysis.

Health-based compliance programs have *inherently complex, dynamic, inter-related* information requirements that include operations and conditions; medical, exposure, and training data; and various types of outcome data (health outcomes, laboratory or other test data, exposure data, PPE usage). Most significantly, employee variability is a key determinant of exposure and health outcomes. Decisions need to be made based upon a tremendous amount of data (raw and interpreted) based upon past results and current conditions, and reassessed periodically or as needed as conditions change.

Temporal trends and associations between exposure and health data should be examined in aggregate to identify significant trends, determine variables related to individual vs. group risk, implement preventive actions that reduce workers' risk of occupational disease, and measure their impact.

## Reporting

The reporting, recordkeeping, and distribution of medical surveillance data includes exposure monitoring and training data, individual employee examination and test results, and aggregate data analysis results. Employees' ability to understand the results of their examinations, tests and written opinions and relate it to their current and future health is one key aspect.

The content of what the physician reports to the employee—the physician's written opinion in the case of most OSHA health standards—may or may not be the same as what is reported to the employer. The opinion must discern between what information is confidential and private. The interpretation of health information or how to report it are often unstructured and may be highly variable among physicians in different practices (and even within the same practice).

At the company level, reporting and recordkeeping for compliance purposes is essential to program administration and liability. Employers with health-based compliance requirements have specific recordkeeping requirements,

reflecting the often long latency period between exposure and disease. OSHA mandates that employee medical and exposure data be maintained a minimum of 30 years after termination of employment. OSHA can request past employee records as long as 5 years previous in the event of an inspection for enforcement action.

The methods of reporting and recordkeeping by the employer are typical of each individual employer. Managing the schedules, service providers, reports, data, and analysis to be seamlessly reported and accessible represents a time-consuming, labor-intensive effort for many companies in highly regulated industries, particularly when these tasks are not automated.

## REQUIREMENTS & COMPETENCIES

### Skills & Knowledge

On the surface, the concept of conducting a medical surveillance (technically, a medical screening) examination as a preventive service seems a simple, easy, mundane service for which little formal training is required, particularly since it does not involve formal clinical diagnosis or treatment. In practice, and if performed correctly and diligently, medical surveillance is a highly complex process that requires knowledge, skills, and experience in many inter-related disciplines: clinical medicine (specifically internal medicine and occupational medicine), public health, biostatistics, epidemiology, toxicology, industrial hygiene, risk communication, and occupational health law.

Both for occupational hazards with overt acute health effects (eg, acute lead toxicity, solvent toxicity, occupational asthma) and for diseases with cumulative, subclinical effects (eg, cancer, chronic lead neurotoxicity, or emphysema), this task can be quite challenging and time-consuming. Having a strong fund of medical (ie, internal medicine) knowledge, ability to elicit detailed medical history in a brief period of time, and differential diagnostic skills are especially valuable skills for physicians to effectively perform this critically important service.

In conducting medical surveillance, the physician's duties include many competencies listed in Table 41-4.

### Qualifications

OSHA health standards specify the minimum requirements for the physician's level of training, expertise, or qualifications to conduct medical surveillance examinations. For those that require medical examinations, the only requirement is that the physician be licensed in the state in which the service is provided. No formal training in occupational medicine or any of the other related disciplines is required, or even recommended, with a few exceptions. Many employers who conduct biological monitoring outside of specific

**Table 41–4.** Physician duties in conducting medical surveillance.

<p><b>Compile and evaluate</b> information about the individual worker by taking a detailed history, assessing specific medical conditions and symptoms, with a focus on the occupational history.</p> <p>Conduct a <b>physical examination</b> focusing on the hazard and on health conditions related specifically to the patient; and recording both pertinent positives and negatives.</p> <p><b>Interpret biological monitoring</b> (eg, blood lead and ZPP levels, or urine cadmium and beta2 microglobulin levels) and/or physiological monitoring data (eg, pulmonary function tests, audiograms, or chest radiographs), including comparative analysis with prior tests and trends among similarly exposed groups (SEGs).</p> <p>Understand the <b>hazard(s)</b> including the relevant <b>toxicology</b>.</p> <p><b>Understand the employee’s job duties, work practices and conditions, exposure controls, including the type and actual use of PPE (respirator).</b> This may include at least one site visit to the facility and/or workplace, and/or knowledge of the particular industry, job, or occupation.</p> <p>Review and interpret applicable <b>exposure monitoring (industrial hygiene) data</b>, and recognize its representativeness and/or level of uncertainty.</p> <p>Understand applicable <b>laws and regulations</b> (eg, standards) and, if applicable, the company’s internal policy and procedures regarding the hazard.</p> <p>Formulate an <b>appropriate differential diagnosis</b> for symptoms (alone and in combinations, including their temporality), examination findings, and laboratory or other test findings to explain particular findings (for symptoms, examinations, and tests) as they relate to the target hazard as well as plausible nonoccupational conditions.</p> <p><b>Synthesize and analyze</b> this information to assess an individual worker’s health status and risk, and render the physician’s written opinion and recommendations (if needed).</p> <p><b>Communicate</b> opinions and explain findings, justification, and recommendations to the patient, employer, and any other vested parties in a disinterested yet compassionate manner that conveys credibility, confidence and caring.</p> <p>Ensure that recommendations or additional requested or required information is <b>followed up, reviewed, and documented</b>.</p>
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OSHA requirements never involve a physician unless a “problem” arises.

In the United States, the selection of a physician(s) to perform medical surveillance services is determined exclusively by the employer. Factors in the decision include availability (proximity, hours of operation, scheduling convenience and flexibility), price, and convenience (eg, provision of other services such as work injury care, ancillary services like preemployment drug screens). Employers may not be aware of the significance or complexity entailed in medical surveillance, particularly because the requirements are codified as regulations such that employers may assume that all doctors are trained and knowledgeable for any problem or service that they or their facility offers.

In many cases, companies rely upon physicians in family practice or urgent care settings to provide medical surveillance services. Medical surveillance examinations in clinics are increasingly performed and/or administered by nurse practitioners as well as occupational health nurses. The OSHA respiratory protection standards deem that any “physician or licensed health care professional” (PLHCP) may review respiratory health information and make the determination of a workers’ fitness to wear a respirator. The OSHA and MSHA noise standards do not require a physician to have any involvement in interpreting audiograms unless a problem or issue arises.

Physician participation and qualifications in other countries may be more rigorously controlled by regulatory bodies.

## CONTENT

### Information to Physician

OSHA health standards typically require the employer to “furnish the physician” with a copy of the standards (including any appendices); a description of the employee’s job duties as they relate to the employee’s exposure; the measured or anticipated level of exposure to the hazard; prior tests and written opinion in the employer’s control.

These requirements underscore previous discussion about employers’ understanding of the requisite skills involved and OSHA’s original expectation and acceptance that any licensed physician is prepared and capable of adequately performing a medical surveillance examination (see section Requirements and Competencies). In practice, the physician should be intimately familiar with the standards or compliance program as well as the particularly work process, exposure ranges (recently measured and historical), work practices (and their variations), PPE assignment and usage, and other related aspects of the workplace and hazard prior to undertaking medical surveillance examinations. When the physician needs additional information, the request should be made and documented clearly to the appropriate person at the company/organization.

Beyond this information, criteria for evaluating medical histories, performing physical examination, interpreting test data, and making a determination are largely left to the physician’s judgment and only rarely are specified by regulations.

### Medical Surveillance Examinations

At the clinical level, physicians participate in medical surveillance by providing medical surveillance examinations and/or interpreting of biological or other physiological monitoring such as pulmonary function testing, audiograms, or chest radiographs. These examinations and tests may be specified by a regulatory standards and/or by a company- or industry-specific policy. The scope of content and reported results is thus dependent on these requirements.

There are overlapping but also distinct purposes and benefits for the employee (patient) and the employer. The purpose of medical surveillance examinations includes one or more of the following.

### A. Identify Medical Conditions

For baseline examinations, the physician who conducts a medical surveillance examination reviews the employee's complete health history (including occupational history) and conducts a physical examination. The history focuses on nonoccupational conditions (diseases), undiagnosed symptoms, or a risk factor (eg, family history, habit or lifestyle choice) which may increase an employee's susceptibility to a hazard, or which could be potentially worsened or aggravated as a result of occupational exposure or conditions, or which could impair a worker's ability to safely work in and around a particular hazard. As an example, for a worker with lead exposure, significant conditions could include an underlying renal disease or reproductive disorder; an unexplained history of fatigue and depression; a strong family history of certain neurologic disorders or inherited hemoglobinopathy; or methamphetamine or marijuana usage which may affect cognition and affect. In a worker with potential exposure to asbestos, a history of emphysema or other chronic lung disease, or a current or past cigarette smoking history would be pertinent medical history to document.

The physician's duty is to determine whether an individual is able to safely perform his job, with or without certain restrictions, additional protective measures, or monitoring. On a periodic (eg, annual) basis, if applicable, the physician assesses the employee's interim health status over the preceding period, elucidating any changes in past and querying about new health conditions, including whether they are diagnosed, undiagnosed, treated, or untreated, and their potential association with the occupational hazard in question. It is important for physicians to recognize that medical surveillance is not intended to fulfill the same function as a preemployment (preplacement) physical exam to determine if the employee is able to perform the job (essential functions).

The medical surveillance examination may be labeled by the employer or by the physician for billing purposes as a "preemployment examination" or "preplacement examination," and the content may include addressing general abilities to perform a particular job, and/or ability to wear PPE, but from a regulatory and preventive perspective the two should not be conflated. Some employers may not realize the distinction or its significance, but it is the physician's duty nonetheless to ensure the proper scope of assessment.

In the course of a baseline medical examination, it is common for a physician to uncover known as well as unidentified preexisting conditions and findings that may or may not be related to the employee's workplace exposure.

Examples include elevated blood pressure (hypertension), heart murmur, or benign or potentially malignant skin lesions. The physician has a duty to inform the employee of such findings, including recommendations on seeking medical diagnosis and/or treatment outside of work. The physician may proffer general information and advice about the risks of and recommendations for changing habits and lifestyle behaviors such as smoking, diet, exercise, or substance use. This information must be documented in the physician's notes, but must **not** be disclosed to the employer. Such admonitions are included in certain OSHA health-based standards.

### B. Identify Potential Nonoccupational (and/or Prior Occupational) Sources of Exposure

The medical surveillance examination should identify and, where feasible, quantify the source(s), extent, duration, and potential or actual health effects associated with prior occupational, environmental (eg, residential, dietary) exposure to the same or related toxicants. For example, the occupational history of employees entering a cadmium or lead surveillance program who previously worked for other employers in the same industry or other industries should be thoroughly documented.

In practice, obtaining and documenting this information can be very challenging for the physician. The employer often does not have access to this detailed information, either from the employee, the former employer, or governmental regulatory agencies. The employee may or may not accurately or completely recall his/her job title, or the results of examinations, biological monitoring tests, or exposure data. In many instances, the employee will not have received or kept copies of his/her medical opinions and test results. In selected cases in which a new employee's current risk in his/her new job can be impacted by unknown or incomplete past such occupational information, the physician has an implicit obligation to request it and review it—even though regulatory agencies such as OSHA have no such requirements or provisions for compelling employees or their former employers from doing so. The physician should carefully document his/her concerns and requests, as well as follow-up communications and findings, in the medical record.

Environmental exposures to toxicants may occur as a result of residential conditions, hobbies, diet, or other recreational activities. Questions of this nature on standard forms may or may not elicit affirmative responses. The questions require carefully reiteration and detailed scrutiny by the physician to determine if and to what extent the information (or lack thereof) may be important at that time or in the future.

Sometimes a new employee's baseline laboratory or physiological tests performed at the time of the medical surveillance examination reveals an abnormality(ies) that may

reflect a known or unknown, preexisting or latent medical condition or risk factor. For example, an employee who begins new employment in a lead-exposed job with a “baseline” blood lead level of 35 ug/dL, or who has a microcytic/hypochromic anemia, may have acute and/or chronic health risks that reflect recent and/or past occupational lead exposures or underlying blood loss or erythrocyte production disease. These findings may warrant the physician to obtain prior medical records. They may necessitate further medical evaluation outside the scope of the examining physician’s purview to obtain a diagnosis from which the physician can more fully evaluate the employee’s risk and advise on any necessary limitations or monitoring requirements. The employer, who is entitled to laboratory information, should be informed that a preexisting condition exists to explain the abnormality, but for confidentiality (privacy) reasons the physician should not disclose the documented or suspected diagnosis.

### **C. Detect Early Symptoms or Signs of Excessive Exposure and/or Adverse Effects**

Perhaps the most widely recognized reason for and function of the medical surveillance examination is to detect clinical evidence—symptoms or signs—of early adverse effects related to the occupational exposure/hazard.

Some surveillance programs require periodic (typically annual) surveillance examinations, or this requirement is triggered if an employee’s biological monitoring test result within a given period has exceeded a minimum regulatory threshold. Many OSHA health standards contain a provision that if the employee “has symptoms or signs of toxicity,” he/she or the employer may/must request a medical surveillance examination. Obvious confidentiality issues and problems are associated with compelling and relying upon an employee to initiate and document a “complaint” to his/her employer about symptoms, or revealing findings to a company-appointed doctor that may have intended or have been afraid to address with the employee’s personal physician (see section Ethical Considerations). It is not uncommon for an employee to present for a regularly scheduled surveillance examination with ongoing health complaints that could—and should—have been raised earlier by notifying the employer and/or his/her physician. Such caveats are one reason for why so many occupational diseases are under-reported and diagnosed so late.

Health outcomes in most medical surveillance examinations are either symptoms—alone or in combinations, each with a temporal pattern and distribution that needs to be characterized—or signs of disease, such as a physical examination or laboratory test finding. Signs may be symptomatic or asymptomatic; and the symptoms may or may not coincide with the symptoms obtained during this history. Symptoms may or may not be work- or exposure-related;

and their cause and relationship to one another may not be obvious to the employee, the employee’s personal physician, or the employer. Nor may certain symptoms, “complaints,” or diagnoses be ones that employers are willing to volunteer to their employer or to the physician.

When a symptom(s) or concern is presented by an employee to the physician, making the correct diagnosis (or exclusion) of an occupational disease can be a challenging, time consuming, and often frustrating process. Even when a diagnosis is not definitive, subtle trends in exposure or health effects that may not be immediately recognized or diagnosed accurately on an individual basis may nonetheless impact a group of workers over time, sometimes after long periods of time or after exposure has ceased. It is especially important for the physician to recognize that certain occupational diseases commonly do not present with “specific” or “classic” symptoms or signs, particularly in their early or subacute phase.

The diagnostic (forensic) process of assessing symptoms for possible occupational toxicity/disease is a key part of residency training in occupational medicine. This process occurs during the medical surveillance examination wherein the physician utilizes all the available, pertinent information: the in-person medical “history”—reviewing/evaluating prior health information obtained during the baseline and any previous examinations; documenting current symptoms (onset, timing, severity, and association with other symptoms) and whether or not the condition has been diagnosed or treated (either by a physician, other health care practitioner, or by the patient); review of any biological monitoring or other data; review of exposure monitoring data, taking into account knowledge of the employee’s actual work duties and work practices and documenting any changes in work practices; and PPE usage.

An objective, thorough synthesis and analysis of this information requires an in-depth understanding of the hazard and its related toxicology or pathophysiology. The physician must understand the toxicology, natural history, and variable clinical presentations of occupational diseases, and be able to formulate a cogent, relevant differential diagnosis for plausible nonoccupational diseases, taking into account the temporality of clinical findings in association with job-specific risk factors. The physician must recognize that many occupational diseases do not present with overt signs or may have reversible effects that may not be apparent during a one-time examination. A pertinent review of systems should address the differential diagnosis, with interpretation and documentation of both pertinent positives and negatives. Similarly, the physical examination should address both pertinent positive and negative findings associated with toxicity as well as applicable potential differential diagnoses of nonoccupational diseases and conditions.

Beyond the individual employee’s clinical findings, the physician should seek objective information to determine

if similar symptoms/findings have occurred among the employee's coworkers (present or past). This may necessitate collection and/or statistical analysis of aggregate and temporal data which, as previously discussed, may or may not be available from the employer. If the hazard is not specifically regulated and/or the employer does not have a written medical surveillance program, information about the toxicology of the hazard must be obtained. If the physician is not already familiar with the company, its processes, and the particular job in question, a site visit should be conducted. Depending on the physician's relationship with the employer, the employer may or may not be willing to adequately compensate the physician for his/her time to perform this assessment, and/or provide the physician with the requested information with which to make an informed determination. This situation is one example of the type of potential ethical dilemmas faced in occupational medicine practice that most physicians in other specialties may not recognize.

If the physician determines that a symptom or sign is an effect of toxicity or resulting from exposure-related aggravation of an underlying medical condition (which may or may not have been previously documented), the basis of this determination should be thoroughly documented. The physician should carefully inform the employee of the findings, including what measures will be recommended to minimize further harm, monitor the employee's health, or correct workplace conditions that have caused or contributed to this problem. The employer must be informed by the physician of the same (in writing), while respecting the employee's right to confidentiality, particularly of unrelated or personal health information.

#### **D. Monitor Trends to Assess Efficacy of Exposure Controls and Need for Program Modifications**

As medical surveillance is commonly defined, systematic tracking of information over time and among similarly exposed groups (SEGs) within a company and/or industry is a primary goal of medical surveillance. In practice, this process is actually rarely conducted in its intended scope at the clinical level. When it is performed by the employer, it is usually limited to analysis of surrogate markers (eg, blood lead levels for lead medical surveillance) using simple summary statistics. Physicians who practice outside of companies, even though they provide medical surveillance examinations, are rarely involved in the internal evaluation of the effectiveness of the surveillance program.

The OSHA health standards and most other countries' comparable standards require determinations of specific parameters such as biological monitoring or examinations to be "analyzed" on a one-at-a-time, employee-by-employee basis. In effect, if the employee "passes," the employer (and physician) puts the information in a folder (paper or electronic)

and leaves it there until the next scheduled examination. Beyond certain parameters such as biological monitoring data being tabulated in a spreadsheet, the rest of the information typically remains unused unless an employee-specific problem arises.

Neither OSHA nor MSHA nor NIOSH requires or offers guidance on tools for companies to measure outcomes and trends to assess compliance program performance. Similarly, no professional occupational medicine organization (eg, American Medical Association [AMA], American College of Occupational and Environment Medicine [ACOEM]) offers such tools to its physician members. Physicians who practice in groups or clinics where different physicians—or other health care professionals such as nurses—examine employees from the same company may not have information systems, or devote any time or resources to share information and identify potentially significant aggregate problems.

As previously discussed, employers find managing the ongoing, complex requirements of health-based compliance programs to be demanding. Administration of health-based compliance program data tends to be especially time consuming, inefficient, and error-prone if it is not systematically managed and automated. Data errors or omissions that go undetected can be propagated over time and impact multiple employees.

Because the risk and disease endpoint is not a discrete event like an accident or lost workday, the complexity of information and applicability to each employee is highly variable. As a result, compliance data and tracking are highly prone to errors, oversights, missing information, and misinterpretation.

OSHA standards were largely developed and promulgated in the 1970s and early 1980s, before the advent of personal computers or databases. To this time, most employers (and their suppliers including physicians) continue to manage such information using paper-based files and folders, or homemade spreadsheets or checklists intended for specification-based safety standards. These methods, some of which are "computerized," are not automated. They are neither robust nor flexible enough to efficiently manage health-based compliance program requirements and data. For example, they are not designed to catch errors, automatically flag and track variable schedules, or provide one-click critical statistical analyses. These limitations create serious, unwanted compliance vulnerability for the company and its employees.

Affordable automated systems that are specific for particular hazards (eg, lead, noise, respiratory protection) customizable to specific company and regulatory requirements are commercially available for employers. Such systems enable employers to manage all their compliance program activities and data, including scheduling, tracking/follow-up, collection, data analysis, and reporting and documentation, enabling them to manage information in a truly seamless manner that minimizes the risk of errors and oversights.

Employers who recognize the value of automating and utilizing their health and safety data to go “beyond compliance” to perform valuable business functions are able to save time and resources while better protecting their employees’ health by having the ability to measure compliance program effectiveness, identify areas that require further attention, and measure the impact of investments in exposure controls.

Physicians may have an opportunity to access such systems as an authorized user. Some physicians have practice management software that allows them to compile and track certain data such as pulmonary function tests or vaccinations, but often such programs do not provide useful data to employers (See Chapter 5).

## EDUCATE & INFORM

Training of employees is a key function for both safety and health. This component is performed largely by the employer, and the role of the medical professional is commonly limited or nonexistent in this area. Methods include in-house training and consultants, and may be done by live classroom sessions, videos, online courses, and/or written materials. The quality and pertinence of training has a significant, albeit poorly studied impact on the effectiveness of all compliance programs. However, the physician should use the opportunity of the medical surveillance examination to answer specific individual health questions related to the compliance program.

The physician should also use the opportunity of one-on-one time with the employee to ask appropriate questions and listen to ascertain the employee’s level of knowledge about the hazard and the exposure controls, and to potentially uncover information about deficiencies or aberrancies which may place this or other employees at increased risk of adverse health effects.

Most physicians perform examinations at their office. Physicians who are able and willing to conduct examinations “on site” may add credibility as well as convenience because their presence is recognized by employees, and because they have the ability to immediately observe or investigate issues raised by an employee during the examination.

## Biological & Other Monitoring

Employers in certain industries, whether regulated under certain health standards or voluntarily, conduct periodic biological monitoring for biomarkers or organ system function (eg, liver, renal, blood), and/or other physiological monitoring such as pulmonary function tests, chest radiographs, sputum cytology, and audiograms. These tests may be performed as part of, or separately (eg, periodically) from concomitant, direct medical examinations. Some employers consider biological monitoring to be medical surveillance. Chapter 42 addresses biological monitoring in more detail.

As it pertains to medical surveillance, the physician interprets the test results and its relationship to the employee’s

health risks and status. For some standards (eg, lead, cadmium), detailed individual interpretation guidelines (requirements) are provided for individual biological monitoring test results. Others (eg, ZPP) are left open ended and thus highly subject to variable interpretation. Interpretations of concomitant physiological tests (eg, serum BUN and creatinine and urinalysis for renal function) are left up to the examining physician—or sometimes the safety officer at the company. Some standards allow for the physician to obtain other tests the physician deems necessary, but do not otherwise provide guidance on which tests, how to interpret them, or whether or to what extent the employer should be responsible for paying for them.

Accurate interpretation of biological monitoring tests as they relate to the employee’s health and the exposure is a very important, yet rarely scrutinized component of the medical surveillance process. Physicians should explain the significance of any clinically significant abnormality and its relationship to the hazard of concern. Physicians should recognize that standard, generic “reference ranges” reported by medical laboratories on test result reports may not accurately reflect the regulatory standards and/or correct interpretation of a result that is not compared to a previous result or trends among similarly exposed workers.

The timing of the test is very important, but often beyond the control of the physician. Employees may be tested in recurring intervals or irregularly; and often employees miss scheduled test dates. The test result may or may not represent a representative value of the employee’s true internal exposure during the interim period since the preceding test. Toxicological interpretation should address risk for acute and chronic health effects. Depending on the toxicant, important temporal variables for the physician to consider include the duration of exposure/employment; gaps or changes in employment/exposure; and the interval of time between tests. For example, an increase of +5 ug/dL in a new lead worker 3 months after starting employment has a very different meaning than the same change in a 20-year lead worker with a high body burden of lead whose last six blood lead results were all between 25 and 35. Depending on PPE usage, changes in biological markers may or may not reflect changes in external exposure to a toxicant.

A significant change (particularly toward higher toxicant exposure or adverse health effects) should always prompt further evaluation and follow-up. Regulatory cutoffs should not be interpreted as absolute; for example, even though OSHA’s threshold for medical examination and repeat test is 40 ug/dL, a level of 39.9 ug/dL should not be interpreted as “acceptable.” However, while outliers should be carefully reviewed to determine their significance, physicians should avoid the practice of “chasing” abnormal test results without further investigation. The possibility of false negative results should also be considered when the data do not “make sense.”

As previously discussed, the test data ideally should be interpreted by not merely eyeballing individual results (as required by OSHA and most other regulatory agencies) but also by evaluating aggregate trends among the group of similarly exposed workers using appropriate statistically analysis. In practice, if such analysis is undertaken, it is usually by the company, and the physician may or may not be asked to review it. This exercise is especially important to the purpose of linking medical surveillance to corrective action, whether determining if exposure controls are effective, or evaluating if individual factors (eg, hygiene) may explain certain aberrations.

## Written Opinion

The physician's "opinion" represents a clinical judgment about the exposure (past), current status (present), and risk for occupational disease (future). The physician's written opinion requires synthesis and parsing of a large amount of synthesized data—exposure, job requirements, PPE, health status, and monitoring data. The opinion is intended to protect the employee's health, and to ensure that the employer is aware of certain risks and takes appropriate action to address these concerns, either immediately or on an ongoing basis.

Most OSHA health standards specifically require the physician to determine whether the employee has a detected medical condition which would place him/her at "increased risk of material impairment" as a result of the employee's exposure to the toxicant. The provision for not disclosing the specific condition for confidentiality reasons must be carefully addressed, since employers have a right to know what to do with the information. The physician should also specify any special protective measures or limitations to be placed on the employee as it relates to the exposure, including any restrictions on respirator use, if applicable.

OSHA health standards require that the biological monitoring or other test results be included with the opinion. The standards do not clearly specify whether just the biological monitoring test, or all the tests in the panel, should be provided to the employer. In certain nations, the employer may be required to obtain a personal release from the employee to receive the test results.

The remainder of the medical evaluation, including the history and examination data, as well as any physician notes, remain part of the confidential medical record. The physician has an obligation to advise employee of detected nonoccupational conditions and should document this advice, but not include it in the written opinion.

## RECORDKEEPING

Physicians may use any format they see fit to record a medical history, their examination findings, and test results interpretation and to communicate the written opinion.

They should recognize that the written opinion form becomes part of the employee's official record and, in the United States, is subject to review by regulatory agencies such as OSHA. In other countries, the regulatory agency may provide a specific form for physicians to complete.

Medical information today is still largely transmitted in "flat file" format, for example, paper forms with handwritten results, dictated reports, and documents that are mailed, faxed, or scanned from physician's offices, laboratories, or diagnostic equipment such as spirometers, audiometers, or respirator fit test machines. How this information is organized for purposes of reporting and analysis is highly variable, and often is not specified by regulations or standards, hazards, industry, and company. Much information is collected in either traditional paper file or folder (ie, filing cabinets), or in homemade spreadsheets.

True database systems specifically designed for managing and tracking surveillance data are now becoming increasingly utilized in certain industries. As physicians move toward "electronic medical records" systems, they should recognize that their own recordkeeping requirements and systems may not coincide with the needs of their client companies and/or regulatory agencies.

## INTERVENTIONS

### Medical Removal

In many cases, the employee who is overexposed (acutely and/or chronically) and/or who manifests early symptoms or signs of overexposure can safely continue to work, sometimes with temporary or permanent restrictions or modifications of work practices or assignments, while his health and/or exposure is monitored closely. Timely follow-up is imperative, and should be the duty of the physician and the employer to ensure this is accomplished. In the case of early detection, a workers' compensation claim may or may not be warranted, and there may not be any compensable disability.

Removal from exposure and/or the job—either temporary or permanent—due to the diagnosis of an occupational disease is a definitive tertiary preventive intervention that has significant ramifications for the worker, the employer, regulatory agencies, and the physician's relationship with all of them. Physicians who perform medical surveillance for specific standards must understand the removal requirements and employee protections provisions and their implications. There is significant room for judgment as to what represents a "material harm" to employees, and to whether symptoms and diagnosis are attributable to the specific workplace hazard.

Certain OSHA standards have "removal protection" clauses that protect the employee's job, rank, and income during any period of physician-mandated temporary removal, as well as minimum criteria for when the employee

may be permitted to resume his/her usual duties. Even with such provisions as law, a removal recommendation impacts the employee's job security, the employer's compliance liability and perceptions by coworkers (including unions, if present), and the physician's credibility and business relationship with the employer. Conversely, there are many employers in noncovered industries (eg, mining companies regulated by MSHA, not OSHA) who routinely elect to temporarily remove employees from exposure when a physician has not recommended it *per se*. They may thus legally rotate employees rather than address the hazard through further exposure controls.

Ultimately, a clinical judgment about causation and risk is required to determine whether removal should be instituted. Further diagnostic testing may be indicated to definitively diagnose the symptom, or to exclude other diseases that are in the differential diagnosis. If the physician determines that the symptom(s) are not specifically related to toxicity or over-exposure, this conclusion also needs to be thoroughly communicated to the patient and the employer. The physician may recommend close or regular follow-up, and/or assessment of the employee by another specialist or the employee's personal physician. The extent to which the surveillance physician should continue to follow the patient should be made on a case-by-case basis.

### **Second Opinion (Multiple Physician Review)**

Depending on the circumstances, including the physician's relationship with the employer and his/her (or his/her practice's) credibility and trust, the employee or the employer may request a *second opinion*. Certain OSHA health standards contain a provision for such second opinions and even third opinions in the event that the first two physicians reach different conclusions. Though such extensive evaluations are rarely conducted in practice, their regulatory provision reflects the extent to which concerns and experiences of exposure-related toxicity was controverted prior to the advent of this legislation, and is ultimately intended to protect the rights of both the worker and the employer.

### **Exposure Reduction/PPE**

In response to a medical condition or symptom complaint, an aberrant test result, an elevated exposure measurement, or a citation or penalty, employers may institute measures to reduce exposures and/or further protect employees' health. The physician should be in a position to be informed about any such intervention, including the results of exposure measurements. The physician should utilize this information in advising on changes in the frequency of biological monitoring testing (temporarily or permanently), and incorporate this information into test interpretation and medical examination results. Once again, the impact of an exposure

reduction often necessitates aggregate temporal data analysis to assess the full extent and distribution of its impact.

Occupational medicine physicians are taught that that "hierarchy" of exposure controls should always start with engineering, then administrative, and lastly PPE. In practice, however, and in many industries, additional engineering controls may not be feasible or practical (particularly if the exposures are already maximally engineered). PPE, particularly respirators, are often a critically important part of exposure control and protection for many workers and jobs in many industries. Therefore, the physician should be prepared to recommend any necessary modifications in PPE assignment or usage that is warranted to protect the worker, with recognition that this method has inherent limitations and requires close observation and assessment (eg, fit testing) by the employer.

## **ETHICAL CONSIDERATIONS**

The practice of occupational medicine, and in particular to the role of the physician in a preventive service such as medical surveillance that involves the employer, the employee, and the physician as both patient (employee) advocate and consultant to (and paid by) the employer inherently create ethical situations and potential conflicts that must be carefully considered and addressed. This section addresses a few of these important considerations.

### **Employer-Physician-Employee Conflicts**

Medical surveillance is one of the only areas of medical practice wherein a nonmedical person is empowered to make decisions and actions that impact the health of others—in this case, workers. At the same time, the employer assumes full accountability and responsibility for the health of its employees in terms of workplace health and safety. In practice, physicians who participate in medical surveillance are often relegated to the role of providing medical screening, while decisions about medical surveillance outcomes and interventions on behalf of individuals or groups of employees are the employer's management's responsibility. The latter representative who interfaces with the physician may be a safety officer, or a consultant with no, some, or significant professional health training or qualifications; or a facility manager, supervisor, or owner with no medical training, or who is located at a corporate office and is unfamiliar with the details of the issues or process.

The physician may observe situations in which identified problems and/or recommendations are either ignored, minimized, permitted to continue, diluted, or incorrectly implemented which directly or indirectly impact or jeopardize employees' health and safety. The physician may or may not be made aware of these actions and may be powerless to rectify them. For example, some employers may temporarily

remove an “over-exposed” employee with an abnormal test result (eg, an elevated blood lead level) and place him/her in another department or job in lieu of modifying exposures. They play this “shell game” to avoid having to invest in controlling exposures through more expensive methods. Conversely, a well-intentioned but inappropriate removal of an employee by a physician can result in a loss of employment and discrimination, even with legislated removal protections in place.

The physician has a duty to inform the employer of such concerns, and to take reasonable measures to ensure that they are acknowledged. As a last resort, a physician whose opinions or recommendations have been rebuffed or ignored may have an ethical obligation to anonymously or even openly report the company to a regulatory enforcement agency or, if applicable, a union. Such an action carries a significant effect on the physician’s reputation, the company, and its employees. Physicians should thus carefully consider the economic value of a service contract to the risks involved with doing business with certain companies.

At the same time, trust and credibility of the physician are the keys to employee cooperation and communication. The physician is providing a service that is paid for by the employer—never by the employee/patient. If a physician loses the employees’ trust—whether through an action or passive acceptance of a situation that endangers one or more employees—he/she may be rendered ineffective and potentially subvert the purpose for which his/her services are engaged. Even an unacceptably long wait to see a doctor in a waiting room can trigger an employee to “bad mouth” the physician or practice to the employer and/or coworkers. Practices in which different doctors see the same patient can further contribute to employees’ perception of a lack of interest or importance. In the case of physicians who own or are employed by medical clinics that provide other profitable services to employers (eg, drug tests, work injury care, physical therapy), a physician’s raising objections may be stifled or undermined by financial interests in maintaining the business relationship.

### Doctor-Patient Relationship

Employees in a medical surveillance program are sent to the physician as a requirement of employment. The physician is almost always not of their own choosing. Employees may learn that the physician practices a specialty of medicine with which they are not familiar.

Even though the physician is examining the employee at the request of the employer, a doctor-patient relationship is established and the applicable standards of ethical care apply. The goal is impartiality while at the same time engendering effective input that benefits the worker(s) and the employer. Such a dual obligation creates inherent conflicts which, if carefully managed, can be highly effective.

When any type of direct clinical evaluation is involved in medical surveillance, the physician’s ethical obligation is to advocate on behalf of the patient. This duty carries many implicit risks and necessitates disclosing any conflicts truthfully and completely. The Physician must advise the employee of any medical condition, occupational or non-occupational, which dictates further medical examination or treatment.

The doctor-patient relationship still exists when the physician reviews an employee’s biological monitoring or other test result without actually knowing or examining the employee. If the physician detects an abnormality that could impact the employee’s health, he has an obligation to directly inform the employee and advise him/her accordingly.

Physicians who provide preventive medical surveillance services should remain objective and protect their balance of obligation between the employer and the employee-patient. It is therefore in the best interest of all for such physicians to not become treating physician for employees, either in general or for a specific problem detected during the medical surveillance examination. Moreover, while the medical surveillance examination affords a unique opportunity for physicians to provide counseling and information about non-occupational conditions and lifestyle—particularly for workers who otherwise are healthy and/or do not have a personal physician or perceived need for medical care—the examination should focus on workplace health issues. This is a conflict of interest or distraction that commonly arises when family practitioners or internists are called upon to conduct medical surveillance, particularly in smaller communities where the availability or proximity of physicians is limited.

### Confidentiality

Physicians who perform medical surveillance services must follow standards of care for medical practice as well as the requirements of the regulations regarding protection of confidential information. For OSHA, this includes 29CFR1910.20 Access to Employee Exposure and Medical Records, as well as requirements in specific health standards. In the United States, the Health Insurance Portability and Accountability Act (HIPPA) applies to some, but not all situations involving the release and maintenance of personal health information by employees to employers. Employees should have access to all medical information in their medical surveillance file.

Physicians who routinely collect health information from the employee on the same (paper) form that they record examination or test results and opinions and send this form to the employer are effectively violating the employee’s right to privacy and patient confidentiality. Even remarks such as “counseled to stop smoking” or “counseled to reduce alcohol intake” have significant medical-legal implications.

The physician also has a duty to protect confidential information learned about the company and its processes and methods. Usually this information is protected in a contractual agreement between the employer and the physician or medical practice.

For the employer, medical information for medical surveillance should be maintained in a separate file from employment information including drug screens.

## Workers' Compensation

A worker who develops an occupational disease, or for certain standards a recordable “injury” (eg, a standard threshold shift under the OSHA noise standard) may have a valid, compensable workers' compensation claim. Workers' compensation claims can be influenced by outcomes of the medical surveillance process. The problems of making the diagnosis of occupational disease and the related issues in workers' compensation are addressed in Chapter 6.

## RESEARCH & OUTCOMES

Millions of workers in the United States alone participate in medical surveillance programs. Billions of dollars are spent by industry for health and safety compliance and much more worldwide. Yet there is a dearth of formal research by government (NIOSH, WHO, ILO) or within the professional organizations (eg, AMA, ACOEM) about the clinical practice of medical surveillance, including content, methods, consistency, or interpretation. In Europe and other nations, governmental bodies are more regularly involved in routine data collection for surveillance and administrative purposes. Nonetheless, the benefits of medical surveillance remain largely uncertain now as they did nearly 20 years ago.

Even with the growing trend in most areas of clinical medicine toward objective performance measures (ie, “evidence-based” guidelines), assessment of outcomes, effectiveness, or other markers of medical surveillance practice is largely nonexistent. In the United States, OSHA, MSHA, and NIOSH (whose mission is to evaluate and improve methods for occupational health and safety) do not routinely collect medical surveillance data. None of these agencies provides tools or guidance on how physicians should perform medical surveillance examinations or biological or other monitoring. Although OSHA and MSHA have enforcement purview, they have no actual regulatory rights to evaluate physician records for content, completeness, documentation, or other aspects of care rendered to workers. Similarly, neither NIOSH nor the U.S. Department of Labor collects any information from employers about these services. Federal and state agencies obtain certain results from biological monitoring tests indirectly through state-mandated laboratory reporting, but these data may not be specifically linked

to medical surveillance examinations, exposure monitoring data, training, or other components inherent to medical surveillance.

Most of the information these agencies receive is in response to problems that arise, such as overexposures or reports of disease. No statistics are available on the number of medical surveillance examinations or biological monitoring tests performed for any given regulated or unregulated hazard, except perhaps for federal compensation programs such as coal workers' pneumoconiosis. The extent to which penalties and citations reflect under-performance of medical surveillance remains anecdotally determined and largely unknown. The largely reactive mode entails enforcement campaigns and additional rule-making. To a much lesser extent, proactive modes such as technical guidance may be promulgated, but usually takes considerable time to develop and disseminate.

Physicians therefore largely determine how they conduct medical surveillance services. Since federal health and safety agencies do not inspect physicians' records to cull data or measure the quality or consistency of medical surveillance opinions, there is virtually no oversight of this practice.

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**SELF-ASSESSMENT QUESTIONS**

Select the one correct answer for each question.

**Question 1: Medical surveillance**

- a. is the same as medical screening in the workplace
- b. excludes medical screening and safety surveys
- c. entails compiling and analyzing the health data from workers over a period of time
- d. is confined by law to physicians and industrial hygienists

**Question 2: Medical surveillance**

- a. evaluates trends of biological monitoring laboratory tests on workers to assess the effectiveness of exposure controls
- b. distinguishes between health effects from exposures and those from preexisting medical conditions or habits
- c. is not required when exposures are below permissible levels
- d. is the process of identifying, quantifying, and removing causative factors that increase the risk of occupational diseases or injuries

**Question 3: Primary prevention methods**

- a. are intended to minimize employee exposure to hazards and risk of injury or occupational disease
- b. must reduce risk to the point where adverse health effects attributable to that agent do not occur
- c. primarily minimize or avoid employee exposure to hazards through engineering
- d. exclude worker training and risk information

**Question 4: Health-based regulations**

- a. are neither exposure driven nor performance based
- b. are set by NIOSH and must be administered by both OSHA and MSHA in the United States
- c. are derived from allowable exposure levels determined by current scientific knowledge about each toxicant
- d. apply to hazardous substances such as lead, asbestos, and benzene

**Question 5: The company's compliance plan**

- a. requires each company or organization to test hazardous materials
- b. is optional if workers do not complain of adverse health effects
- c. must be reviewed and reevaluated at regular intervals at least annually
- d. excludes outcomes measures

**Question 6: Action level (AL)**

- a. is determined by OSHA for employees whose exposure to a regulated substance exceeds the PEL
- b. initiates medical surveillance
- c. triggers removal of employees with adverse effects resulting from overexposure
- d. ensures that employees will not experience any adverse effects associated with exposure to a toxicant

**Question 7: OSHA and MSHA requirements for medical surveillance**

- a. specify that the company determine the minimum requirements for the physician's level of training, expertise, or qualifications to conduct medical surveillance examinations
- b. require federal review of physician credentials by NIOSH
- c. require employers to be aware of the significance or complexity entailed in medical surveillance
- d. are codified as regulations such that employers may assume that all doctors are trained and knowledgeable for any problem or service that they or their facility offers

**Question 8: Confidentiality of employees' health information by examining physicians**

- a. is not required for information obtained during examinations provided to workers at employers' expense
- b. is waived by OSHA for purposes of risk reduction requiring company participation
- c. prevents discussion of drug use, smoking, and alcohol consumption with the patient
- d. usually is protected in a contractual agreement between the employer and the physician or medical practice

**Question 9: Most OSHA health standards**

- a. require employers to analyze temporal trends and associations between exposure and health data using statistical methods to assess the efficacy of exposure control methods
- b. are updated at least every 5 years to reflect current scientific knowledge and technology
- c. are efficiently managed using standard business tools and methods such as spreadsheets, checklists, and paper files and folders
- d. require that physicians evaluate health effects and risks of employees on an individual basis, not as a group

Question 10: Temporary removal of an employee from an exposure by a physician

- a. must first be approved by the company to ensure the employee's job and pay is safeguarded
- b. is required only when the results of the employee's most recent biological monitoring or other test exceed the allowable regulatory threshold
- c. can be based upon the physician's assessment of the employee's medical condition which places the employee at increased risk of adverse health effects resulting from exposure
- d. is the most effective way for the company to prevent employees from being overexposed to hazardous workplace agents