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Importance of and Approach to Taking a History of Exposures to Occupational Respiratory Hazards

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Abstract

Occupational respiratory diseases are caused by exposure to respiratory hazards at work. It is important to document those exposures and whether they are causing or exacerbating disease because these determinations can have important impacts on diagnosis, treatment, job restrictions, and eligibility for benefits. Without investigation, it is easy to miss clinically relevant exposures, especially in those with chronic diseases that can have work and nonwork causes. The first and most important step in identifying exposures to respiratory hazards at work is to take an appropriate history. For efficiency, this is a two-step process. An initial quick screening history is done by asking only a few questions. Follow-up questions are asked if there are positive responses to the screening questions or if an occupational etiology is suspected based on the clinical presentation. Electronic health records have promise for facilitating this process. Follow-up to the screening history may include additional questions, evaluating additional sources of information about workplace exposures, and medical testing. Radiographic findings or tests conducted on noninvasive samples or lung tissue can be used as biomarkers. Online resources can be used to learn more about exposures associated with occupations and industries and to see if investigations evaluating exposures were performed in the patient's own workplace. It is important to adhere to the patient's wishes about contacting the employer. With patient consent, the employer can be an important source of information about exposures and, if a problem exists, has an important role in taking corrective action. Consultation for challenging cases is available from a variety of professional and governmental entities. If a clinician identifies a significant public health issue, such as an occupational disease outbreak, it is important to notify relevant public health authorities so that steps can be taken to prevent additional exposures and appropriately care for those already exposed.

Keywords

- respiratory disease
- occupational
- hazardous exposure
- medical history
- exposure assessment

Occupational respiratory diseases are caused by hazardous agents encountered at work. Some diseases occur acutely after exposure and their relation to work is obvious. Others take many years to manifest after initial exposures, and identifying a causative role of a work-related exposure in an individual patient in this situation can be challenging. Although inhalation is generally the most important route of exposure, other routes can also be relevant to respiratory disease. For example, immune sensitization to occupational allergens underlying occupational asthma can be induced by skin contact.[1]

Identifying and attributing occupational exposures as causes of respiratory disease development, progression, and exacerbation enables accurate diagnosis and more

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effective treatment. For example, considering occupational asthma, avoiding exposure to a causative agent by removing it from the work environment can improve patients' outcomes medically by improving their asthma control and financially by allowing them to remain employed.[2] Documenting an occupational cause of respiratory disease may enable some patients to obtain benefits to which they are entitled.[3] Occasionally, identifying an association between an occupational exposure and a disease leads to a new discovery with important occupational health benefits. For example, because a clinician identified a cluster of patients from a single microwave popcorn manufacturing facility with the rare disease bronchiolitis obliterans and reported it to public health officials, follow-up investigations were able to show that the respiratory toxicities of certain flavorings such as diacetyl were causative. This led to recognition that exposures needed to be controlled in a range of industrial settings, providing protection for many workers beyond those involved in the original outbreaks.[4]

There is widespread recognition that workers throughout the world face many types of occupational hazards,[5] including work-related exposures that can cause or worsen pulmonary diseases.[6] However, clinicians often do not obtain occupational histories, ask about work-relatedness of symptoms, or explore potential causative associations between workplace exposures and disease manifestations.[7–10] Failure to explore these issues may cause delays in diagnosis[8,10] and possibly contribute to greater morbidity and decreased measures of health-related quality of life.[11] Because of the strong relationship between occupational disease and socioeconomic factors, delayed recognition of occupational disease is also a health equity issue.[8,12]

This brief narrative review will provide clinicians caring for patients with respiratory symptoms or disease with a practical approach to identifying potentially relevant occupational respiratory hazards and an approach to follow up as appropriate based on patients' individual situations.

Challenges to Identifying Causation of Respiratory Disease by Exposures to Respiratory Hazards at Work

It can be easy to attribute respiratory symptoms or diseases to exposures in work settings when they occur acutely or, in the case of chronic diseases, when they are typically caused by exposures specific to certain occupational settings. Examples of acute effects include the several types of acute inhalation injuries, such as due to irritant gases, smoke inhalation, and toxic metals.[13] Examples of chronic diseases mostly attributable to occupational exposures include silicosis, coal workers' pneumoconiosis, chronic beryllium disease, asbestosis, and mesothelioma. Other chronic diseases can have both work- and non-work-related causes, making definitive attribution to a work exposure in an individual patient uncertain and difficult. Frequently encountered examples include asthma, chronic obstructive pulmonary disease, and lung cancer.[14,15] In contrast, epidemiological attribution at the population level for these diseases and others such as idiopathic pulmonary fibrosis, hypersensitivity pneumonitis, sarcoidosis, pulmonary alveolar proteinosis, tuberculosis, and community-acquired pneumonia can be established with greater certainty (►**Table 1**).[6] Even in the face of uncertainty, it is important for clinicians to consider the likelihood that occupational exposures have caused or contributed to individual patients' respiratory disease status.

Table 1 Occupational contribution to nonmalignant respiratory diseases

Respiratory disease	Occupational population attributable fraction
Classical pneumoconiosis: asbestosis, silicosis, and coal workers pneumoconiosis	Essentially 100%
Sarcoidosis	30%
Pulmonary alveolar proteinosis	29%
Idiopathic pulmonary fibrosis	26%
Hypersensitivity pneumonitis	19%
Asthma	16%
Chronic obstructive pulmonary disease	14%
Chronic bronchitis	13%
Community-acquired pneumonia	10%
Silica-associated tuberculosis	2.3%
Health care worker associated tuberculosis	1.0%

Source: Modified from Blanc et al.[6]

Interactions between work and nonwork exposures can be another challenge to identifying a causative role for hazards at work in causing respiratory disease. For example, some respiratory hazards like poor indoor air quality due to dampness and mold, outdoor air pollution, and secondhand tobacco smoke can be found in both work and nonwork settings and thus both settings can be sources of exposure to the same agent. Another type of interaction occurs when different agents encountered in work and non-work settings have the same adverse health outcome and both contribute to risk. A well-known example is the supra-additive interaction between asbestos and tobacco smoke in increasing risk for lung cancer.[16]

Recognition that numerous types of exposures encountered in many settings over a lifetime all contribute to risk of disease underlies the concept of the exposome, which has been defined as "the totality of exposures individuals experience over the course of their lives and how those exposures affect health."[17] The same authors categorized exposomic exposures as belonging to the internal domain (unique to individual–physiology, age, genome, etc.), the specific external domain (occupational and environmental, diet, lifestyle, etc.), and the general external domain (sociodemographic such as educational level, socioeconomic status, etc.).[17]

Genetic susceptibility is another factor that can modify risk for certain occupational respiratory diseases after

exposure to causative agents at work. A well-known example is genetic modification of risk for beryllium sensitization and chronic beryllium disease in workers exposed to beryllium.[18] Still, even in those with genetic susceptibilities, occupational respiratory diseases do not occur without exposure to causative occupational respiratory hazards. As famously stated by Dr. Judith Stern, "Genetics loads the gun, but environment pulls the trigger."[19]

Obtaining an Occupational Respiratory Hazard Exposure History

Taking an accurate and complete medical history (which includes environmental and occupational exposure components) is the most important first step in documenting exposures to occupational respiratory hazards. It is important to obtain a history of nonwork exposures that might contribute to respiratory symptoms or disease. This nonwork exposure history should address habits, such as use of combustible and noncombustible tobacco and cannabis products, alcohol, and illicit drugs. Also ask about hobbies that have respiratory exposures. A general environmental history can address outdoor and indoor air quality concerns by asking about the location of residence (urban, suburban, rural); general outdoor air quality in the location; use of biomass fuels such as wood, indoor dampness, and mold; and exposure to secondhand tobacco smoke and animals.

It is important to be efficient in taking a history of exposures to occupational respiratory hazards. There is an epidemic of stress, fatigue, and burnout in U.S. health workers. Excessive workloads due to understaffing and administrative burdens are important causative factors.[20] Especially in this context, it is important to take histories efficiently and in a way that maximizes the benefit of the information obtained for time spent to obtain it. Many authorities recommend a two-step approach to taking a history to identify potentially relevant occupational exposures.[3,21–25] The first step involves asking a few screening questions to help assess whether an occupational respiratory disease might be present (►**Table 2**). If the screening questions are suggestive of occupational causation of disease or if an occupational etiology is part of the differential diagnosis for the patient's clinical presentation, a more detailed history may be indicated. For example, adult onset of asthma or interstitial lung disease should increase the index of suspicion for causation by an occupational exposure. In appropriate cases, the additional time invested in a detailed history will help the clinician to better understand potential exposures to occupational respiratory hazards.

Table 2 Screening questions for occupational exposure history

In chief complaint and history of present illness
What kind of work do you do?
Do you think your health problems are related to your work?
Are your symptoms better or worse when you're at home or at work?
In review of systems
Are you now or have you previously been exposed to dusts, fumes, chemicals, radiation, or loud noise?
Have you ever held a job that requires the use of personal protective equipment?

Sources: Newman,[24] Banerjee and Kuschner,[21] and Papali and Hines.[25]

A number of approaches to the initial screening have been suggested.[25] A straightforward approach is the one first suggested by Newman.[21,24,25] He suggests that the following questions be addressed as part of the chief complaint and history of present illness:

- *What kind of work do you do*?" A job title alone will often be insufficient to understand the exposures encountered at work. For example, if someone says they work in manufacturing or construction, it is important to ask about what specific tasks they do to understand their exposures. Workers can have very different exposures depending on the materials they work with (e.g., wood, metal, masonry) and the specific tasks they carry out (e.g., cutting, grinding, drilling). It is often important to specifically ask about both occupation (the type of work someone does) and industry (the type of business they work in). For example, a janitor working in an elementary school may experience very different exposures than a janitor working in a textile mill or a chemical manufacturing plant.
- *Do you think your health problems are related to your work*?" If the answer is yes, it is important to follow up with questions about temporal relationships between work and symptoms (see next bullet). Other useful follow-up questions include asking if the patient took on a new job, if something changed at work before the health problems started, or if there are coworkers who are experiencing the same health problems.
- *Are your symptoms better or worse when you're at home or at work*?" Temporal relationships between work and onset and severity of symptoms can be an important clue to the presence of occupational respiratory disease. For example, the symptoms of occupational asthma often improve when someone is away for work over a weekend or on vacation.

Newman also suggested the following question as part of the review of systems[24]:

- *Are you now or have you previously been exposed to dusts, fumes, chemicals, radiation, or loud noise*?" A positive response to this question could trigger more detailed follow-up questions to better characterize these exposures.

An additional screening question has also been suggested[25]:

- *Have you ever held a job that requires the use of personal protective equipment*?" A positive response could trigger questions about the nature of the hazard and whether personal protective equipment was worn consistently and appropriately.

If the patient responds affirmatively to screening questions or the clinical presentation suggests a possibility of respiratory disease caused by exposure to occupational respiratory hazards, then a more detailed occupational history is indicated. A detailed work history will include all jobs listed from the current time to first employment. Information to obtain for each job includes industry, occupation, dates of starting and leaving, tasks performed, known hazardous exposures including whether there were extreme unusual events like fires or spills, use of personal protective equipment such as respirators, use of engineering controls like ventilation or other controls like work practice controls to limit hazardous exposures, whether the job was associated with or preceded by development of respiratory symptoms or disease, and whether the patient left the job because of respiratory symptoms or disease.[25] As noted earlier, it is also important to ask about past exposures outside of work.[26] To save time for the clinician, the patient can be asked to complete a questionnaire providing this detailed information. Excellent examples of questionnaires have been published.[25,26]

A "life events calendar approach" can be used in questionnaires or in interviews as a cognitive tool to improve recall of past jobs.[27] This involves asking about past jobs in relation to important personal life events such as graduations, marriage, and birth of children. To obtain very detailed follow-up information about past jobs, it can be useful to have the patient draw a map of their work area and a process flow diagram showing the sequence of activities in their workplace, including the locations where the activities are carried out and whether they were performed by the patient. The process flow diagram can include information about the specific respiratory hazards associated with each activity.[28]

Electronic health records can be used as a tool to assist with obtaining and using work information. There have been important advances in setting standards for adding occupational data to electronic health records. The National Institute for Occupational Safety and Health (NIOSH) has developed a standardized framework called occupational data for health (ODH).[29] Broad categories of information in the ODH framework that can potentially be populated in electronic health records include employment status, retirement dates, jobs (past or present), longest held (usual) work, volunteer work, combat zone periods, and work of household members of minors (to address the potential for "take-home" hazards such as on contaminated clothing). ODH now forms the basis for several Health Level 7 interoperability standards, intended to facilitate sharing of information across health information technology systems.[29]

In addition to providing simple tools to clinicians like standardized questionnaires, electronic health records have the potential to enhance care through more advanced functions such as clinical decision support.[30] In the case of respiratory disease, clinical decision support algorithms could be triggered by specific clinical presentations. For example, if the patient were to present with adult onset or worsening of asthma, the electronic health record could prompt the clinician to ask three questions[31]:

- Do/did your asthma symptoms start at your current/recent workplace?"
- Do/did your asthma symptoms worsen at work?"
- Are asthma symptoms different (e.g., better) on days off work and/or holidays?"

If there is a positive response to any of the three screening questions and the patient has asthma, then the electronic health record would be triggered to supply work-related asthma tools including a clinician-utilized checklist of high-risk exposures, educational materials for clinicians and patients, and referral resources.[31]

In addition to the relatively simple algorithm described above for occupational asthma, availability of standardized work and clinical information in electronic health records provides an important foundation for application of more advanced artificial intelligence as an aid to clinicians.[32]

Follow-up Evaluation

Although taking an informative medical history is the first and generally most important step to identifying workplace exposures to respiratory hazards, additional information is often needed to fully document what exposures occurred, when they occurred, and to gain a sense of the level of exposure. This additional information can help strengthen the diagnosis for medical purposes and in some situations can strengthen claims for compensation and other benefits to which the patient may be entitled.

Medical Testing for Biomarkers of Past Exposure to Respiratory Hazards

Clinicians can supplement the medical history with medical testing for biomarkers of past exposure to occupational respiratory hazards. There are two main classes of biomarkers, those of effect and those of exposure.[33] A biomarker of effect can be present if a hazard is absorbed into the body and induces a biological response that is strongly associated with that hazard. For example, chest imaging findings of bilateral pleural plaques are consistent with past asbestos exposure, although other causes are possible.[34] Eggshell calcifications of hilar lymph nodes are associated with past history of exposure to respirable crystalline silica and silicosis, although they are also found in coal workers' pneumoconiosis and sarcoidosis and have been reported in Hodgkin's disease after irradiation and in blastomycosis, histoplasmosis, amyloidosis, and scleroderma.[35]

Immunological responses to occupational antigens can also be used as biomarkers of effect. For example, a positive beryllium lymphocyte proliferation test indicates induction of a cellular immune response by past exposure to beryllium.[36] Positive tests for immunoglobulin E (IgE) sensitization to occupational allergens such as positive wheal and flare skin tests or laboratory tests for serum-specific IgE suggest previous exposures to occupational allergens.[37]

Specific antibody responses to antigens causing hypersensitivity pneumonitis are also examples of biomarkers of effect.[38]

Biomarkers of exposure are generally more direct reflections of past exposures to specific agents and absorption of those agents into the body.[33] They frequently involve measurement of the hazard/chemical itself or its metabolites. These may be measured in noninvasively obtainable samples like blood, urine, or exhaled air or in more invasive samples like bronchoalveolar lavage or lung tissue samples. Plasma indium levels are an example of a noninvasive biomarker of exposure that can be used to assess body burden of an agent and is related to risk of indium lung disease.[39] Examples of invasively obtained biomarkers of exposure include measurement of ferruginous bodies or asbestos fibers in bronchoalveolar lavage or lung tissue as a biomarker of asbestos exposure[40] and crystalline silica particles in lung tissue as a biomarker of respirable crystalline silica exposure.[41]

The American Conference of Governmental Industrial Hygienists (ACGIH) publishes a list of Biological Exposure Indices (BEIs) that can be measured in urine, blood, or exhaled breath.[42] Many are biomarkers of exposure and are based on "the chemical itself; one or more metabolites; or a characteristic, reversible biochemical change induced by the chemical."[42] ACGIH provides quantitative information about expected BEI values in healthy workers exposed at occupational exposure limits (OELs) established by ACGIH called the Threshold Limit Value – Time Weighted Average (TLV-TWA).

Gathering Data about the Workplace: Importance of Protecting Patient Confidentiality

For some patients, it will be important to supplement the information obtained from the medical history and laboratory findings with additional documentation obtained through the employer, such as safety data sheets (SDSs) and other relevant records. However, before proceeding to collect this information, it is very important to be sensitive to patient confidentiality issues and discuss them with the patient. Despite the existence of legal protections in the United States For workers who communicate with management about occupational safety or health matters, including requests for SDSs or reporting work-related injuries or illnesses,[43] some workers will fear that their employer might react to learning that they might have a work-related illness by taking adverse actions such as job reassignment or even job termination, putting their livelihood in jeopardy. It is important to discuss this issue with the patient and respect the patient's wishes about whether and how to contact an employer for purposes of gathering information about possible exposures and what the employer can be told. If the workforce is large enough, anonymity can potentially be protected by only telling the employer that one of its current or former workers is a patient and you need to learn some details about their possible work exposures. In smaller workforces or for those with unique occupational roles, disclosure of information to an employer, even with the patient's consent, could inadvertently cause the employer to learn the identity of the employee. The American College of Occupational and Environmental Medicine (ACOEM) has published a statement on "Confidentiality of Medical Information in the Workplace," which outlines the importance of protecting patient information, obtaining the patient's consent prior to disclosing information, and that patients should be informed of impending information disclosure, even in the cases where it is required by law.[44] In the United States, if the clinician works in a practice or a health plan that is a Health Insurance Portability and Accountability Act (HIPAA) covered entity, then the clinician must abide by standards for protecting the privacy and security of the patient's information. However, once a diagnosis of work-related illness is made, certain disclosures without patients' consent are possible under HIPAA, for example, for public health purposes.[45]

Safety Data Sheets

U.S. employers are required to make SDSs for all hazardous chemicals in the workplace readily available to workers.[46] The SDSs are produced by chemical manufacturers and distributors and importers of chemicals and products containing chemicals. SDSs include much useful information such as the chemical name(s) and properties, health hazards, recommended protective measures, and safety precautions. Because workers are supposed to have access to SDSs, a clinician should consider asking the patient to bring copies of SDSs to the clinic for review. Although SDSs are very helpful for documenting specific chemical exposures, they do have some weaknesses. If a chemical ingredient of a product is deemed a trade secret, it does not have to be identified in the SDS and the clinician may need to reach out to the manufacturer to learn its identity. Also, depending on the writer, SDSs may vary somewhat in quality and completeness.

Internet Resources

Resources available on the Internet can help the clinician supplement what is learned through the patient history and review of SDSs to better understand what exposures to respiratory hazards might have occurred in the workplace and their potential respiratory toxicities. The following are examples of useful resources, but there are many additional helpful resources available on the Internet.

O*NET is a resource supported by the U.S. Department of Labor.[47] It contains over 1,000 occupational titles and codes, which can be searched to identify job duties and tasks, which in turn can inform evaluation for potential work exposures based on the patient's occupation.

The website "Industrial Hygiene Hazard Identification and Exposure Risk Assessment by Market Segment" is maintained by the American Industrial Hygiene Association (AIHA).[48] It includes descriptions of activities and hazards in a range of industry sectors and subsectors, which can inform evaluation of potential work exposures based in the industry where the patient works.

Haz-Map is an interactive website that shows relationships between a range of jobs and job tasks with hazardous exposures and occupational diseases.[49]

The Occupational Safety and Health Administration (OSHA) website provides much general information about work exposures and health effects.[50] If the specific workplace where the patient works has been the site of an OSHA enforcement inspection, information about the results of the inspection (potentially including measurements of exposure levels) can be obtained via the OSHA website.[51]

NIOSH also provides much general information about work exposures and health effects.[52] One particularly useful resource for learning about specific chemicals is the "NIOSH Pocket Guide to Chemical Hazards."[53] NIOSH can also perform health hazard evaluations of specific workplaces after valid requests from workers, unions, or employers.[54] If the specific workplace has been the site of a NIOSH health hazard evaluation, the report may be available for download on the NIOSH website. Reports typically include qualitative and possibly quantitative exposure assessment information.

Other governmental agencies also provide useful information for detailed research about possible exposures at work. The U.S. Environmental Protection Agency (EPA) website contains a wealth of information about specific chemical exposures and their health effects.[55] The U.S. National Institutes of Health maintains PubChem, a very helpful database for searching the characteristics and toxicities of chemicals.[56]

Additional Records Available from the Employer

If the patient provides fully informed consent, then the employer can be contacted to learn about potentially hazardous workplace exposures. The employer will have knowledge of the patient's work tasks, potentially hazardous exposures, and preventive interventions. The employer may also have knowledge of whether other employees have experienced similar health effects and the patient is entitled to request access to OSHA 300 and 300-A logs documenting workplace illnesses and injuries from the employer.[57]

The employer may also have exposure assessment records that are relevant to the patient and can be shared. In some cases, regular assessment of exposure might be required to document compliance with governmental regulations. In other cases, particularly in workplaces that employ industrial hygienists, the employer might be carrying out their own workplace exposure monitoring program to ensure that exposures are controlled in high-risk areas. If available, discussion of potential exposures with a health and safety professional employed at the worksite can be extremely valuable.

Interpreting Quantitative Airborne Exposure Measurements Obtained from the Workplace

Results of quantitative measurements of airborne respiratory hazards in workplaces must be interpreted with care. It is important to assess whether the measurements are relevant to the individual patient. Some measurements are obtained using personal sampling. This is performed by placing samplers on individual workers. A common type of sampler is a pump that collects air at a known flow rate from a worker's personal breathing zone. Air is pumped through sampling media such as a filter or thermal desorption tube. The sample is then analyzed for content of the hazardous agent. Airborne concentration is calculated by dividing the amount of hazardous agent (often expressed as mass) by the volume of air sampled. Depending on the agent being sampled, other more sophisticated sampling and analytical approaches are also used. It is unusual for everyone in a workplace to be sampled, so it is important to know if a personal sample was obtained from someone doing work that was similar enough to the patient so that the measurement is relevant to the patient's own exposure.

Area air sampling is another approach to assessing exposures to airborne respiratory hazards in workplaces. Instead of placing the sampler on an individual, as is done in personal sampling, area sampling is performed by placing air samplers in fixed locations. It is important to know if the location sampled was relevant to the patient's work.

Concentrations of airborne respiratory hazards in workplaces are variable. For example, the airborne concentration at a given point in time may be related to the intensity of work being performed (which generates the hazard) and effectiveness of engineering controls such as ventilation (which removes the hazard). Thus, quantitative airborne levels of a hazard may be greater in a workplace operating at 100% capacity than one operating at 50% capacity. Similarly, quantitative airborne levels may be greater in the winter when a facility's windows and doors are closed than in warmer weather when they are open.

To evaluate the degree of hazard that is present, quantitative exposure measurements are often compared to OELs established by governmental organizations and other authoritative groups (►**Table 3**). It is important to recognize that these OELs are generally established to reduce the risk of disease to an acceptable level, not to eliminate risk altogether. Also, some OELs are established based on the feasibility of measuring the airborne hazard at concentrations around the OEL. In view of this, and in view of the expected variability in measurements over time including unanticipated high-exposure events such as spills, causation or exacerbation of a disease by an airborne workplace hazard is not ruled out by quantitative measurements below an OEL.

Preventing Patients' Exposures to Occupational Respiratory Hazards

If exposure to an occupational respiratory hazard is identified as causing or exacerbating a patient's respiratory disease, preventing future exposures is an important aspect of treatment. The employer may be able to take steps like eliminating the exposure by removing a specific agent from the workplace or by substituting for it with a different agent that is less hazardous. Even if the agent remains in the workplace, it may be possible to reduce exposures with engineering controls like general or local exhaust ventilation or by making changes in work practices. Another option may be increased use of respiratory protection, although that should be carried out within the context of a comprehensive

Table 3 Common occupational exposure limit terms and definitions

Term	Acronym	Definition	Issuing organization	Stipulation
Recommended exposure limit	REL	Occupational exposure limits to protect workers from hazardous substances[a]	NIOSH	Recommendation
Permissible exposure limit	PEL	Occupational exposure limit not to be exceeded[b]	OSHA and MSHA	Enforceable by OSHA (general industry, maritime, construction) or MSHA (mining)
Short-term exposure limit	STEL	A limit that should not be exceeded at any time during the workday[c]	ACGIH, NIOSH, OSHA, and MSHA	Enforceable when issued by OSHA and MSHA
Threshold limit value	TLV	The concentration level to which a worker can be exposed to daily over a working lifetime without having adverse effects[d]	ACGIH	Guideline
Immediately dangerous to life or health values	IDLH	A concentration of an air contaminant that can cause death or immediate or delayed permanent adverse health effects or prevent escape from an environment	NIOSH	Recommendation

Abbreviations: ACGIH, American Conference of Governmental Industrial Hygienists; MSHA, Mine Safety and Health Administration; NIOSH, National Institute for Occupational Safety and Health; OSHA, Occupational Safety and Health Administration.
[a]REL is typically expressed as a time weighted average (TWA) exposure for a defined period, such as for up to a 10-hour shift during a 40-hour work week.
[b]PEL is typically expressed as an 8-hour TWA (1 work shift).
[c]STEL is typically a TWA measured in over a specified sample time (e.g., 15 minutes). Some substances also have an OSHA-assigned "ceiling limit" that is a value that should not be exceeded at any time
[d]Typically a TWA based on an 8-hour work shift and a 40-hour work week

respiratory protection program to ensure proper respirator selection, fit, maintenance, and worker training. These measures may help patients to improve clinically and remain employed.

Clinicians may sometimes need to consider removal of a patient from a workplace if exposure to the problematic respiratory hazard cannot be eliminated or reduced enough to improve the patient's clinical condition.[58] In this situation, clinicians in the United States will need to be aware of applicable federal and/or state laws and may need to interact with employers' human resources staff and attorneys representing the patient. For example, under the Americans with Disabilities Act, the employer may be required to make a reasonable accommodation allowing the patient to remain employed if it doesn't impose an undue hardship on operation of the business.[59] Even though removing an employee from a workplace is sometimes best from a purely medical standpoint, any potential medical benefit needs to be weighed against adverse effects on the patient's employment and the many benefits of employment.

Expert Clinical Consultants and Public Health Support

Medical consultants can provide much assistance to clinicians caring for patients who have respiratory disease potentially caused by exposure to occupational respiratory hazards. For example, they can help in characterizing exposures, confirming diagnoses, and addressing aspects of treatment such as evaluation of work abilities and restrictions, disability evaluations, and assistance with seeking benefits. Occupational and Environmental Medicine (OEM) specialists can be very helpful in these aspects of care. The Association of Occupational and Environmental Clinics (AOEC) maintains a clinic directory that can help those without ready access to an OEM specialist.[60] Pulmonary disease specialists with expertise in occupational respiratory disease are also important resources, especially for patients whose respiratory disease is clinically challenging to diagnose and treat.

Industrial hygienists are very important professionals for understanding and controlling exposures to occupational hazards. Engaging with an industrial hygienist employed at the work site can be very beneficial to understanding and controlling hazardous exposures.

If the clinician suspects that the workplace is experiencing a significant occupational health problem that is not being addressed, such as a disease outbreak affecting many workers, it is important to reach out to public health authorities to evaluate and correct the situation. Agencies potentially able to provide help include local and state public health departments, NIOSH, and OSHA. Depending on the situation, local and state public health departments[61] and OSHA[62] may have

enforcement authorities. If requested by the employer, OSHA may provide consultative services. Alternatively, a request for a health hazard evaluation may be submitted to NIOSH.[54] Regulations require three current workers, a union at the worksite, or the employer to initiate the request. By reporting to public health agencies, the clinician can help others with similar exposures to the patient.

Conclusion

Occupational respiratory diseases are caused by exposure to respiratory hazards at work. It is important to establish if a patient's respiratory symptoms or disease is caused or exacerbated by work exposures because this has important impacts on treatment, assessment of work ability and restrictions, and potentially eligibility for benefits. It is not always possible to definitively establish causation at the individual level for diseases with work and nonwork causes, but documentation of potentially relevant hazardous exposures at work enables assessment for a potential contribution.

The first and most important step to identifying exposures to respiratory hazards at work is to take a concise screening history. This can be done efficiently by asking only a few questions. More detailed follow-up questions are only required if there are positive responses to the screening questions or if an occupational cause is high in the differential diagnosis of the clinical presentation. Electronic health records have promise for efficiently helping with this process.

The clinical exposure history can sometimes be supported by documenting biomarkers of effect or exposure. A variety of resources can be used to research potential exposures expected to be encountered in a patient's job and to see if evaluations have been performed documenting exposures in the patient's own workplace. Because of potential adverse effects on employment, it is important to adhere to the patient's wishes about contacting the employer. However, with the patient's fully informed consent, the employer can be an important source of information about potentially causative exposures and help with patient treatment by eliminating or controlling exposures in the workplace.

Consultation is available from a variety of professional and governmental entities. If the clinician identifies a significant public health issue, such as an occupational disease outbreak, it is important to notify relevant public health authorities.

Note

The findings and conclusions in this report are those of the author(s) and do not necessarily represent the official position of the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention.

Conflict of Interest

None declared.

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