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## Introduction

The evaluation and management of work-related health conditions offers the family physician a unique medical challenge that may extend far beyond the confines of a clinic or a hospital. The floors of a lumber mill, the flight deck of a 747, and the dark tunnels of a coal mine are but a few of the environments that can become the concern of the family physician caring for the worker.

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## From Antiquity to Nanotechnology

The practice of occupational and environmental medicine has its roots in antiquity. Concern for the health of workers has been documented as early as ancient Egypt when Imhotep, considered the grandfather of occupational medicine, described treatment for injuries sustained by pyramid workers. Similar writings are found in ancient Greece, when both Hippocrates and Pliny the Elder wrote on the maladies of miners, horsemen, and metalworkers. Throughout history, many figures have advanced the health of workers. However, it is Bernardino Ramazzini that is considered the “father” of modern occupational medicine. Through his dedication to exploring the ailments of the worker, Ramazzini expanded the breadth and depth of occupational medicine by promoting worksite visits. The toils of his studies resulted in one of the earliest textbooks of occupational medicine, *De Morbis Artificum Diatriba*, which was published in 1700 [1].

Since the time of Ramazzini, there have been many pioneers of the specialty. One more modern contemporary that deserves special attention is Dr. Alice Hamilton. In the early 1900s, Hamilton not only advanced our understanding of the toxicological dangers of work, such as lead, but she also championed the importance of workplace safety. Hamilton’s work and accomplishments extend far beyond the care of workers; she was a prominent social activist and also the first female faculty member of Harvard University [2].

Over the last two decades, the most important change in occupational medicine has been a focus on the importance of work. In the past, there was great emphasis in ensuring people were fit for work, leading to the exclusion of disabled persons from the productive work they desired. Moreover, a large part of treating work-related injury and disease was removal from work on medical grounds. Although this may be still necessary in some cases, it is now recognized that work is crucial for health, socialization, and personal identity. Conversely, absence from work is frequently demotivating, demoralizing, and fraught with risks of depression, adverse mood changes, deleterious effects on career progression, and iatrogenically induced prolonged/permanent disability. Poor outcomes have also been demonstrated in occupational injuries compared with similar injuries sustained from sport and recreation. These considerations have led to a revised approach to work injuries. Occupational medicine is now focused on maintaining functional capacity by returning injured workers to productive employment via appropriate work restrictions and case management. It is in this endeavor that occupational medicine finds itself at a frontier within the practice of medicine.

The blossoming concept of work as a healing entity, coupled with the development of novel compounds and industries, such as graphene and nanotechnology, presents ongoing health challenges for workers and occupational medicine providers.

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## Practice Overview

At the level of the individual patient, occupational and environmental medicine (OEM) focuses on the care of the injured worker, the prevention of workplace injury and illness, and the improvement of worker health and productivity. A division of preventative medicine, OEM is one of the smallest medical specialties recognized by the American Board of Medical Specialties. However, the expertise OEM provides in regard to worker health and population management skills renders it an ever important specialty.

Despite this need, there is a shortage of OEM physicians. Indeed, only 83 physicians achieved board certification in OEM [3]. In addition, with the number of board-certified occupational medicine specialist in decline, it is anticipated that nearly 1700 OEM physicians will retire in the next 10 years. The result is that there will be a 33 % reduction in specialist numbers [4]. As such, there is a burgeoning practice opportunity for family physicians that are willing to pursue additional training and education in the treatment of workers.

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## Epidemiology

As the number of specialist OEM physicians declines, the incidence of work-related health conditions continues to be significant. In 2013, there were approximately three million nonfatal workplace injuries and illnesses reported in private industries. More than half of these involved an injury severe enough to require work modifications, job transfer, or time off from work [5]. Private sector laborers, freight/stock/material movers, and heavy/tractor trailer truck drivers reported the greatest number of days off work due to a workplace injury or illness. Persons 45–54 years of age had the highest incidence of injuries, suffering a rate of 119.9 per 10,000 workers. Males had an incidence rate of 119.2 per 10,000, substantially higher than the female rate of 97.0. Some of the most common causes of work injuries across all industries were musculoskeletal disorders (36 %), contact with objects (25 %), same-level falls (17 %), and overexertion (12 %) [6].

While rarely considered during national debates over the financing of medicine, the direct cost associated with work-related health care is tremendous. In 2012, the cost of worker's compensation-related health care was approximately 62 billion dollars, split nearly evenly between medical and indemnity costs [7]. This cost closely approaches the estimated total 2012 US cost associated with the treatment of asthma (75.9 billion), mental disorders (83.6), and cancer (87.5 billion) [8]. Moreover, the true costs of

occupational injuries and disease are much larger when indirect costs of lost productivity are included. The loss of productivity exceeds the direct costs of diagnosis, treatment, and indemnity payments (wage replacement while off work) for injured workers. While this data increasingly provides incentives for employers to prevent work-related injury and disease, much of society remains unaware of the cost of injured workers.

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## Legal Underpinnings and Entities

Given that work is an integral part of the lives many of the patients family physicians will see and work may affect their presentation of illness or injury, a basic understanding of the key regulatory bodies and systems is necessary for successful practice and delivery of care.

### Worker's Compensation (WC)

WC is the oldest form of social insurance in the United States and the third largest source of support for disabled workers after Social Security and Medicare. Workers' compensation allows for the provision of monetary compensation for medical and rehabilitation costs and lost wages to certain workers with work-related injuries or disabilities. Before workers' compensation, litigation was usually necessary for full compensation. Workers rendered injured or ill due to a work-related injury or illness bore the full brunt of medical care and lost wages unless employers voluntarily offered compensation. Founded on the principle of providing a compulsory "no-fault" form of insurance for workers injured in the course of employment, employers are held responsible for compensation for work-related injuries and illnesses, regardless of findings of cause, through an insurance mechanism. In this no-fault system, in exchange for certain and prompt compensation, the worker accepts compensation limited to the standard amount specified by each state, whether or not the payment fully covers lost wages, pain, and/or suffering. As such, WC is the exclusive remedy for injured workers.

The first workers' compensation laws were passed in 1911 by nine states, with Hawaii being the last state to do so in 1963. A similar system had already existed in Europe with Germany being the first to pass these laws in 1884. While WC laws are similar overall, differences can exist between states and federal and private entities. It is important for the family physician to be aware of this and familiar with their local jurisdiction nuances [1].

### **Occupational Health and Safety Administration**

At the turn of the twentieth century, workplace industrial accidents became more publicized and public outrage increased. In the wake of disastrous workplace accidents, such as the Triangle Shirtwaist Factory fire, regulatory agencies and acts, such as the Safety Appliance Act and the United States Bureau of Mines, took form. With the increased industrialization that followed World War II, the incidence of workplace injuries increased dramatically. The dangers of industrialization were compounded by the increasing use of industrial chemical, many of which had unknown health effects. It is estimated that in 1970, there were 14,000 work-related fatalities in the USA.

In 1970, the US government passed the bipartisan Occupational Safety and Health Act (OSH Act), the purpose of which was to create and maintain the safety and health of workers in the USA through training, education, and assistance. Perhaps, the most powerful component of the act is its general duty clause, which states each employer:

shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees.

The clause enables the broad protection of workers and workplace safety, even in the absence of specific applicable regulations or standards.

The act led to the establishment of the most recognized government agency pertaining to

work safety, the Occupational Health and Safety Administration (OSHA). OSHA, a component of the Department of Labor, is the government's regulatory agency for work safety. Some of the agency's many services include regulatory inspections and enforcement of standards, such as those pertaining to lead and blood-borne pathogens [9].

### **National Institute of Occupational Safety and Health**

The OSH Act also created the National Institute for Occupational Safety and Health (NIOSH) as part of the Centers for Disease Control and Prevention. The purpose of NIOSH is to perform research on worker injury/illness and to make recommendations on workplace safety issues. Examples of NIOSH's research areas include the danger of antineoplastic medications to health-care workers and offshore gas/oil extraction. In addition, NIOSH also funds education, research, and training in occupational health through 18 education centers, 10 agriculture disease-related centers, and 28 training grants. The roles of NIOSH and OSHA are distinct, with OSHA being the regulatory aspect of work safety [10].

### **Americans with Disabilities Act (ADA)**

The purpose of the ADA, first passed into law in 1990 by Senator Tom Harkin of Indiana, is to prevent discrimination against individuals with disabilities in transportation, public accommodations, communications, governmental activities, and employment [11]. The ADA was one of the most important pieces of social legislation in the USA and represented a major change in thinking. A particular impetus to the act was the ongoing exclusion from employment of many Americans with disabilities or a history of disabilities, even when such individuals had improved medically and/or wished to work. The act was amended in 2008 by the Americans with Disabilities Act Amendment Act (ADAAA).

A complete understanding of the nuances of this complicated piece of legislation is beyond the

scope of this chapter. However, a basic understanding of ADAAA by the family physician is important as they may be called upon to opine on the physical capabilities of workers.

First, private employers with greater than 15 employees, state/local governments, employment agencies, and labor unions must provide accommodations for applicants and workers with disabilities as long as such accommodations would not impose undue hardships on the employer. Examples of accommodations include alteration of work schedules and the use of modified equipment. Undue hardship is defined generally as “an action requiring significant difficulty or expense,” when taking into account the applicable covered employer’s situation.

Second, the act prevents pre-hire inquiries, such as physical examinations, into an applicant’s medical status. However, an employer may require a physical examination to determine if an individual can perform the essential functions of a job after an offer of hire has been made and before employment commences. Such examinations must be required of all employees and not on an individual basis. Pertinent records must be kept confidential and separate from employee human resources files.

### **Family and Medical Leave Act (FMLA)**

FMLA was passed into law in 1993. The purpose of this law is to provide employees 12 weeks of unpaid, job-protected leave for qualified medical conditions. In addition, health insurance benefits as part of employment must be continued during such leave. FMLA is applicable to all public agencies, public and private elementary/secondary schools, and employers with greater than 50 employees. To qualify for FMLA, employees must have worked for an employer for 12 months, worked 1,250 h in those 12 months, and worked in a location where the company has greater than 50 employees within a 75 mile radius. Qualifying reasons for leave include the birth/care of a newborn, the initiation of foster care/adoption by the employee, the care of a family member with

serious medical conditions, or a serious medical condition of the employee that prevents work [12].

Many family physicians encounter this piece of legislation as a multipage form with a request from patients for physician certification. Satisfactory completion of this documentation will allow appropriate protections for both the patient and employer and efficient execution of this law.

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### **General Approach to the Evaluation of the Worker**

The evaluation of the worker requires considerations and elements that extend beyond normal history and physical examination.

### **The Standard for Documentation**

Understandably, the provision of occupational health services occurs in a legal framework. The family physician should assume that any records pertaining to a work-related health condition will be scrutinized by numerous stakeholders, including insurance adjusters, employers, and legal representatives. For example, claims adjusters require detailed information in order to appropriately manage a worker’s compensation claim. A failure to provide precise documentation can lead to a loss of appropriate medical treatment covered by workers compensation, costly delays in care, and erroneous assignment of financial/legal responsibilities [13]. As such, attention to detail and accuracy is required throughout occupational health care. It would not be overdramatic to state that if scalpels are the tools of the surgeon, the instruments of the successful occupational health provider are words.

### **The Systematic Injury History**

The majority of occupational health-related treatment by the family physician involves the care of an acutely injured worker. Among the most common work-related injuries seen in primary care

clinics involves low back pain, and this complaint can be used to demonstrate the proper documentation of a potentially injurious work event. Certainly, it would not be sufficient to simply document a “patient injured while lifting at work.” Legal needs aside, such a vague description sheds little insight into neither the diagnosis nor avenues for preventing future recurrences. Similar to a forensic investigation, any report of a potentially work-related injury should include the mechanism of injury, the location, the time of the event, and the employees involved in the event. A useful paradigm for recalling these crucial elements is the “4 Ws”: what, when, where, and who [14].

## Medications and Substances

Outside of the obvious dangers of alcohol and illicit drug use at work, several medications can result in sedation and other dangerous side effects. There has been a massive increase in opioid use in health care [15]. Likewise, there is growing potential for prescription medications, such as opioids, to cause serious and dangerous impairment of workers on the job. Because of this, a detailed description of a worker’s medication regimen is required for those who have suffered an acute injury. Special attention should be paid to dosing schedules. A potentially sedating medication, such as cyclobenzaprine (Amrix, Fexmid, Flexeril), may not pose a work safety issue if the employee only works day shifts and the medication is taken in the evening.

## An Objective Physical Examination

The physical examination of the worker differs from general primary care in one crucial way: an emphasis on objective evidence. Insurers are conscious of the possibility of fraud, and thus, there is a strong desire to limit liability for nonwork-related conditions. Consequently, insurers place an emphasis on objective indications of pathology. The family physician should note as many objective indications of pathology, such as

straight-leg tests and reflexes, as possible during the examination. Indications of nonorganic etiologies should also be noted.

## The Occupational History

Understanding the nature of a patient’s work is vital for the treatment and management of work-related medical conditions. Many US physicians currently rarely inquire about work activities during clinical encounters [16]. This finding is unfortunate as family physicians are frequently the first physicians to evaluate work-related diseases.

The occupational history need not be an overly tedious and lengthy task [17]. In the case of a simple injury, only a brief history of pertinent facts may suffice. For more complicated diagnoses, such as an occupational infection or chemical injury, more detail may be required. Obtaining the occupational history can be expedited by having patients complete an occupational history questionnaire prior to the clinical visit.

An occupational history begins with obtaining basic information such as job title, employer, work schedule, and general work activities, in particular the activities surrounding the presenting injury or illness in some cases. Special attention should be given to any recent changes at work, such as new equipment/chemicals or alterations in work schedule. It should be noted that a simple description of the current job and tasks is not sufficient when evaluating workers with ailments. Some exposures, such as asbestos, can take several decades to produce health effects. Thus, a review of a patient’s entire work history may be necessary in some instances.

## Psychosocial Factors

The complicated interplay between work, health, legal entanglements, and worker’s compensation demands a careful assessment of psychosocial factors when caring for workers. For example, psychiatric conditions are associated with maladaptive coping mechanisms and delayed recovery from work-related low back pain [18]. Based



on such findings, ACOEM guidelines recommend assessing for psychosocial factors, such as work monotony, relationship with supervisors, and job satisfaction [14]. The purpose of inquiring about such stressors is not to discredit the patient or to imply malingering. Rather, identifying such complications can provide additional treatment options, such as pain counseling or depression treatment, and help to identify and remove otherwise seemingly insurmountable barriers for recovery and return to work [19].

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## **General Approach to the Treatment of the Worker**

### **Communication**

Occupational health care can be a challenging endeavor for the family physician. Such emotions are compounded for the patient, many of whom have significant home, work, and financial stressors in addition to the medical condition. Uncertainty, such as with diagnosis and return to work, has been linked to poor recovery and outcomes with work-related care [20]. Unchecked catastrophizing by the worker has been shown to impede improvement [21]. Thus, thorough and clear communication by the physician is of paramount importance. For example, setting return to work dates and educating workers on how to prevent reinjury and recurrence can promote early RTW [22]. Catastrophizing can be mitigated by giving proper context to injuries and diagnostic findings and by positive reinforcement regarding the ability of the worker to perform their job duties. Using modified duty/light duty to progress the worker toward full duty by allowing them to remain in the workplace, surrounded by the culture of work, can help toward successful maintaining of work status and return to work.

### **Medications**

In occupational injuries, the physician is also repeatedly tasked with managing pain. Unfortunately, the increasing use of opioids for the

treatment of non-cancer-related pain has led to a greater potential for injured workers to be using impairing medications while at work. This in turn is associated with risks of repeated or new injuries associated with loss of vigilance during work tasks. In the interest of the worker and the public, the family physician treating work-related pain should minimize the use of impairing medications, such as opioids and muscle relaxers. This is especially true for what are called “safety-sensitive” work positions. A systematic review of nearly 22,000 studies by ACOEM found a positive association between opioid use and motor vehicle crashes. Based on this, ACOEM now recommends that workers performing safety-sensitive work, such as commercial driving or crane operations, should not use opioids acutely or chronically [23]. Early use of opioids for the treatment of acute, work-related low back pain has been shown to be associated with prolonged disability, higher medical costs, and prolonged opioid use. Much pain from occupational injuries can be effectively managed with acetaminophen and nonsteroidal anti-inflammatories [24].

### **Return to Work**

It is now apparent that one of the most important ways the family physician can serve the best interest of the worker is with appropriate management of return to work. Many family physicians inappropriately assign time off from work for injured patients. One of the primary reasons for this is a perceived duty to be a patient advocate. Family physicians, like other medical providers, are motivated by a desire to minimize suffering and pain. Thus, when a worker complains of pain at work, removal from work appears to be in the patient’s best interest. However, it is the converse that is true. It has been showed repeatedly that work, in safe environments and with proper guidance, is of paramount importance to health. Removal from work is associated not just with financial loss, but also increased mortality from cardiovascular-, respiratory-, violence-, alcohol-, and accident-related etiologies [25]. Likewise, continued work maintains physical and mental conditioning.

**Table 1** Common work-related musculoskeletal injuries/conditions seen by family physicians and relevant risk factors

Condition	Potential occupational risk factors	Nonoccupational risk factors
Low back injury [30–32]	Repetitive loading of spine Inadequate rest time at work Awkward lifting Prolonged standing High job demand/stress	Psychiatric disorders Age Smoking
Carpal tunnel syndrome [32–34]	High hand force Prolonged hand force Vibration Repetitive motion	Diabetes Pregnancy Hypothyroidism Genetic predisposition
Rotator cuff tear [32, 35]	Prolonged shoulder flexion Forceful pinching Work above at or above shoulder height Work stress	Age Overhead sports
Slips and falls [36]	Weather Poor lighting Slippery surfaces	Inappropriate footwear Age Fatigue

Thus, it is the return to work as safely and as soon as possible that is almost always in the worker's best interest. This endeavor should be the goal of the family physician's advocacy.

Appropriate return to work can also be adversely affected by the time constraints of the busy family physician's schedule. Time limitations are in turn compounded by a lack of training in return to work by most medical providers outside of occupational medicine. To improve the efficiency of return to work discussions, ACOEM and the American Medical Association (AMA) have created guidance documents for return to work recommendations by primary care physicians [26]. One of the unifying features of the guidelines is the use of a step-based algorithm [27].

The proper use of the algorithms is dependent on having a sound understanding of the definitions of restrictions, limitations, and tolerance [28]. Restrictions are activities that a worker should not perform due to personal risk or risk of hurting others. Limitations are needed when there is a task the worker cannot perform due to their medical condition. Tolerance is the ability of the worker to endure symptoms. It is important to remember that tolerance cannot be determined reliably by medical science. Ultimately, it is the worker that decides to tolerate symptoms that do not cause worse injury or pose a danger to self/others [27].

Removing a worker from work without considering activities the worker can perform within the context of work or even working full duty with the presenting injury is a disservice to the worker and to society as a whole. The family physician should try to gain an understanding of the job tasks and direct the worker/patient accordingly.

## Representative Common Occupational Conditions

### Injuries

Musculoskeletal injuries represent the bulk of work-related medical conditions encountered by most physicians. In a survey of family physicians between 1997 and 2000, 56 % of work-related care by family physicians involved acute problems, and 48 % involved musculoskeletal chief complaints [29]. In 2013, musculoskeletal disorders accounted for 33 % of nonfatal workplace injuries in all industries. Sprains, strains, and tears were most common, accounting for 38 % of all injuries requiring time off work. The most work-affected body parts were the back (36 %), shoulder (12 %), and knee (12 %). Injuries were most frequent among nursing assistants, laborers, and freight/stock/material movers [4].

The treatment of many common industrial injuries is covered elsewhere in this text. Table 1



summarizes a few of the work-related injuries most frequently seen by family physicians and lists their potential risk factors.

## Conditions: Infections

Exposure to infectious agents at work is a risk faced by many industries. This risk is especially robust in health-care-related fields, and the family physician can expect to encounter work-related infectious exposures frequently, even if the provider is not actively providing occupational health-care services. An estimated 5.6 million workers are at risk from blood-borne pathogens. Between 1995 and 2007, there were 30,945 exposure events in the National Healthcare Safety Network. 82 % involved percutaneous injuries and 79 % percent involved blood products. Nurses and providers were the most frequently injured, involved in 72 % of cases [37].

By far, the most concerning health-care work-related infections are HIV, hepatitis B, and hepatitis C. The potential impact of these infections in the health-care workforce is so great; the subject is addressed specifically by the OSHA Bloodborne Pathogen Standard (29 CFR 1910.1030). In an effort to prevent unnecessary transmission of blood-borne pathogens, the CDC provides in-depth and updated postexposure management protocols on their website. Management options can include rapid initiation of antiretrovirals for confirmed HIV exposures and the use of the hepatitis B immunoglobulin/hepatitis B vaccine for hepatitis B exposures. Unfortunately, there is no postexposure treatment for hepatitis C other than monitoring.

While these viruses have remained the primary blood-borne pathogen concerns for health-care workers, there are several other infectious agents not involving blood exposures that can be encountered in the workplace. For example, the incidence of pertussis, measles, and even Ebola has increased in recent years, and the management of work-related outbreaks of these infections can become the responsibility of the family during the care of a community. In addition, classic concerns such as tuberculosis, chicken pox,

conjunctivitis, streptococcal pharyngitis, malaria, and typhoid fever can wreak havoc on the worker and workplace. The management of each of these conditions is outside the scope of this chapter, and the reader is directed to the CDC for further direction.

Finally, zoonotic infections can also pose serious risks for workers. Table 2 summarizes some of the zoonotic illness and their associated occupations and settings.

## Conditions: Chemical and Environmental Exposures

The EPA's catalog of chemicals used at one time or another in industry exceeds 80,000. Most recently, the EPA estimates that 7,500 chemicals were used by industry in 2012 [40]. Many such chemicals can result in serious health effects, including cancer and death. Similarly, both indoor and outdoor environments can produce symptoms and illness, even in the absence of industrial chemicals. Table 3 summarizes some of the most well-known chemically and environmentally induced health conditions.

The chemical and environmental exposures most likely encountered by the family physician are limited to a few select conditions. The most prevalent are occupational skin diseases, building-related illness, and occupational respiratory conditions.

### Latex Allergy

To meet compliance with the Bloodborne Pathogen Standard, which required barrier methods during health-care delivery, the use of latex gloves increased dramatically. This resulted in an increase in immediate hypersensitivity reactions associated with an IgE type I response to naturally occurring rubber from the *Hevea brasiliensis* tree. Those at risk include health-care workers, food handlers, security personnel, and emergency service personnel (i.e., paramedics). Atopy is an independent risk factor. Rates of latex allergy have decreased in recent years with changes in latex processing and the increased use of latex-free gloves [43].

**Table 2** Unique occupational infections, symptoms, and associated work and environments

Condition	At risk occupations/environments	History/pearls
Brucellosis	Veterinarians Exposure to fluids and aborted products of conception from infected livestock Consumption of products from infected livestock, such as unpasteurized cheese/milk Laboratory personnel, via aerosolization Slaughterhouse workers Recent international travel	Undulant fever with sweats and malaise Systemic involvement Can be detected via antibodies and treated with antibiotics
Rabies	Animal bites, especially bats Biologists, veterinarians Greenhouse workers	Postexposure treatment can consist of rabies immunoglobulin and four vaccines Consider preexposure prophylaxis in those working with animals, especially in endemic areas abroad
Q fever	Veterinarians Animal caretakers Farm workers, especially those working with sheep, cattle, and goats Living downwind from contaminated farms or farm products (i.e., manure, dust) Laboratory personnel	Caused by <i>Coxiella burnetii</i> Exposure is typically through products of conception, fluids, or dust Extremely resistant to environment Widely variant clinic presentation, including flu-like illness, hepatitis, pyrexia of unknown origin, and pneumonia Liver function tests may be elevated in many patients
Scabies	Health-care workers Spread via direct skin to skin contact with infected individuals Higher risk in crowded environments, such as nursing homes or correctional facilities	Caused by human itch mite, <i>Sarcoptes scabiei</i> Intense itching and rash Can be spread from an asymptomatic carrier Usually no symptoms for 2–6 weeks
Leptospirosis	Farmers, ranchers, veterinarians, sewer workers, rice farms, laboratory personnel, and loggers Spread in urine of farm animals Higher incidence in tropic regions Exposure occurs via contaminated soils or animal tissue/urine Subsistence farming and urban slums Flooding associated with disease outbreaks	Caused by spirochetes from the genus <i>Leptospira</i> Varying clinical presentation, from subclinical to death Usually fever, myalgias, headaches, cough, nausea, and vomiting Look for conjunctival suffusion
Tularemia	Laboratory personnel Farmers Veterinarians Hunters Landscapers Meat handlers Animal or insect bites, especially ticks	Caused by <i>Francisella tularensis</i> Ocular and aerosolized exposure also possible Can survive long term in adverse water conditions Nonspecific symptoms, usually a combination of fever, malaise, and anorexia Fever may be intermittent
Rat-bite fever	Laboratory personnel Pet shop workers	Caused mostly by <i>Streptobacillus moniliformis</i> Exposure via bites/scratches or fecal contaminated food Clinical course varies depending on infectious agent

References [32, 38, 39]

Symptoms from the reaction can range from simple urticaria to life-threatening anaphylaxis. Symptoms typically begin within a few minutes to an hour of contact. Inhaled exposure can occur in the presence of powdered latex. The diagnosis is confirmed by skin prick testing or RAST testing

for specific IgE. The primary strategy for management is avoidance [32].

### Sick Building Syndrome

Sick building syndrome (SBS) refers to a constellation of general symptoms attributed to indoor

**Table 3** Chemicals/elements and associated health conditions

Chemical/elements	At risk occupations/environments	History/pearls
Asbestos	Construction Shipbuilding Insulators Environmental contamination	Lung cancer Mesothelioma Pathology can develop several years after exposure Malignancy risk significantly increased with smoking
Silica	Sandblasters Concrete/masonry workers Mining	Chronic obstructive pulmonary disorder Scleroderma Increases risk of tuberculosis Unlike coal, causes calcification of hilar lymph nodes
Coal	Coal miners, especially those at the drilling face or with other heavy dust exposures	Lung fibrosis Unlike silicosis, no increase in TB or fungal infections in simple cases
Vinyl chloride	Used to make polyvinyl chloride, which is in turn used to make many plastic products Production of automobile upholstery/parts and housewares	Acutely, causes CNS effects such as dizziness, drowsiness, and headaches Chronic exposure can damage GI system and result in liver cancer
Benzene	Rubber manufacturing Chemical and petroleum production Shoemakers Printers Steel workers Gas station employees	Acutely, can cause dizziness, unconsciousness, and death Chronic exposure can lead to leukemia
Carbon monoxide	Forklift operators Foundry workers Miners Garage attendants Mechanics Firefighters	Headache Tachypnea Cyanosis Syncope Binds strongly to heme O <sub>2</sub> -carrying sites, decreasing available O <sub>2</sub> for the body
Hydrogen sulfide	Sanitation workers Farmers Natural gas drilling and refining Workers in confined spaces, especially low-lying, marshy areas with hot weather and little wind	Health effects on concentration (ppm) Symptoms can vary from the smell of rotten eggs, to conjunctivitis and respiratory tract irritation, to immediate collapse with 1–2 breaths at levels of 700–1,000 ppm
Pesticides	Agricultural workers Greenhouse workers Pesticide handlers (i.e., crop dusters, chemical manufacturers)	Wide variety of health effects, depending on type of pesticide involved Must consider pesticide toxicity, exposure, and absorption together when evaluating cases Workers covered by the Agricultural Worker Protection Standard
Lead	Inhalation of lead fumes during burning and sintering Lead reclamation (i.e., battery recycling) Glassmakers, pottery workers Military and law enforcement Munition workers Welders	Lassitude Malnutrition Gingival lead line Encephalopathy Paralysis of wrist and ankles Renal failure
Cadmium	Smelting/refining Manufacturing/construction Plating processes Battery production Dietary intake: shellfish, meat by products, liver, food stored in cadmium-glazed containers	Renal failure Chemical pneumonitis Lung cancer Osteomalacia Japanese rice paddies irrigated with cadmium-contaminated water resulted in an epidemic of osteoporosis in the 1940s Tobacco leaves concentrate cadmium, leading to chronic exposure in smokers

References [41, 42]

environments [44] including headache, upper respiratory symptoms, and fatigue. While abnormalities in specific components of indoor air quality (IAQ) can be the cause of such complaints, symptoms are often reported in environments where IAQ is within normal limit, often other than increased carbon dioxide levels, indicative of a mismatch between airflow and human occupancy. Although some consider many instances to be psychogenic, indoor air contaminants below the irritation threshold concentration can cause symptoms, especially those with low odor thresholds.

Several factors can contribute to indoor air quality detriments. Environmental elements to consider when assessing SBS include building ventilation rates, temperature and temperature fluctuations, humidity, chemicals (i.e., formaldehyde and ozone), and odors. Personal factors, such as atopy and contact lens use, and psychosocial factors have linked to SBS.

As SBS can involve significant anxiety, clear and open communication is important to effective management. Initial evaluation begins with an interview of affected employees and a work site walk-through. Following the initial investigation, management options can include improvement of ventilation rates, temporary removal from work environments, measures of environmental parameters by an industrial hygienist, cleaning of ventilation systems, and reengineering.

## **Mold**

Of all the naturally occurring environmental contaminants, none seems to invoke as much fear as mold. Mold spores are omnipresent in the environment and reproduce in the presence of moisture. The most common types include *Penicillium*, *Aspergillus*, *Cladosporium*, and *Alternaria*. Molds can cause specific conditions including allergic asthma, but there is little evidence to support fears that airborne mycotoxins produce specific illnesses [45]. Similar to SBS, the evaluation of potential mold-related health conditions begins with an interview of the worker and an evaluation of the work environment that focuses on abnormal indoor moisture.

Remediation of mold and dampness in buildings may improve symptom and consists

primarily of removing the source of moisture and visible mold contamination [46]. Such cleaning could require intermittent, temporary relocation of employees. In all circumstances, clear communication with patients and the workforce is of paramount importance.

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## **Specific Types of Occupational Examinations**

As a branch of preventative medicine, one of the goals of occupational medicine is the prevention of injury and illness in the workplace. To fulfill this objective, the family physician may be asked to perform a variety of preventative and regulatory examinations for workers.

### **Posthire, Preplacement Examinations**

ADA prevents employers from discriminating against applicants on the basis of disabilities. However, this protection from discrimination must be balanced with ensuring optimum safety of employees and the public. Typically performed at the request of an employer, the purpose of the posthire, preplacement examination is to ensure that an employee can perform the essential functions of a job safely.

To ensure proper screening, it is important that the family physician have an adequate description of the employee's job duties and requirements. While this information could be obtained from the employee, a more reliable source would be a full job analysis document provided by the employer. Job analyses describe the duties and physical requirements of a work position.

### **Fit for Duty, Return to Work Examinations**

Fit for duty examinations are sometimes necessary when an employee has been off of work for an extended period of time. Similar to preplacement examinations, the purpose of the FFD examination is to ensure an employee can

still perform the essential functions of their job. An example where such an examination would be necessary is in the case of an employee who recently underwent a knee replacement and is hoping to return to work as a carpet layer.

Again, it is important that the family physician acquire adequate information to assess the employee's current medical status and work requirements when performing such assessments. In particular, the family physician must ensure that the patient does not pose a safety risk due to changes in medications.

Some family physicians are uncomfortable in providing fitness for duty assessments, especially when the results are not to the workers' desire. In such confusing scenarios, rather than contributing unnecessary risk to the patient, other workers, or the public, we suggest that family physicians seek the assistance of their occupational medicine colleagues.

## Commercial Driver Medical Examinations

In 2013, there were 4,405 fatal occupational injuries [47]. Two out of five of these fatalities were transportation-related events. Of the 1,740 transportation-related fatalities, three out of five involved motorized land vehicles. With such data, ensuring the safety of commercial drivers and public roads is one of the most important concerns of occupational medicine and also one of the most common avenues for family physicians to provide occupational health care.

To obtain a commercial driver license, the driver must successfully meet the medical and physical requirements described by 29 CFR Part 391.41. This federal regulation provides in-depth information on medical requirements, such as blood pressure limits, and disqualifying medical conditions, such as epilepsy. Until recently, commercial driver medical certification examinations could be performed by a variety of medical providers. Unfortunately, due to a lack of standardized training for examiners, there was varying adherence to federal regulations and guidelines. To remedy this, the Federal Motor Carrier

Association has required that after May 2014, all commercial driver examinations be performed by certified commercial driver examiners [48]. Certified commercial driver medical examiners receive standardized training and must pass a certification examination. This move has reduced the number of available examiners and provides family physicians a both important and lucrative occupational health opportunity.

## Comprehensive Occupational Health Programs

Many corporations and public sector organizations offer multifaceted programs designed to protect and improve the health of their employees. These programs include components such as health promotion, disability management, international health and travel medicine, benefit design, and workforce data analysis. These programs offer fascinating opportunities to improve health and medical outcomes for a defined population. With additional training, the family physician can assist with such programs.

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