Occupational Health Guide

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Founded in 1916, the American College of Occupational and Environmental Medicine (ACOEM) is the nation's largest medical society dedicated to promoting the health of workers through preventive medicine, clinical care, research, and education. The College represents more than 4,500 physicians and other health care professionals specializing in the field of occupational and environmental medicine (OEM).
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INTRODUCTION

Occupational Medicine – A Basic Guide
Luke P. Lee, MD, MPH, CIME, MBA, CPA

This guide is an introduction for any health care professional interested in rendering occupational medicine services anywhere in the United States. It was sponsored by the ACOEM Private Practice section and written by 20 contributors—all of them occupational medicine providers; experts in a range of industries, occupational risk areas, and injuries; and members of ACOEM.

Occupational medicine is a subspecialty of preventive medicine that focuses on the interrelationship between the health of workers and their workplaces. Whether providers are embedded in a corporation or contracted to provide services to an employer, or they simply work in a community setting, they often find themselves evaluating and treating conditions related to their patients’ work. Through this basic guide, we aim to share with our primary care colleagues tips and knowledge from our experiences in this field. From recognizing the unique hazards of mining or agricultural work to coaching patients on returning as quickly as possible to work after an injury, we hope that our collective experience will help to broaden others’ understanding of the goals and approaches of occupational medicine.

This guide is particularly designed to help health care providers who juggle multiple roles find the information they need to provide work-related health services to their communities. Many providers, especially in rural areas, find themselves serving both individual patients and the companies or agencies that employ them, whether they are conducting fitness-for-duty evaluations, surveillance, evaluation of work-related injury causation, or treatment. The purpose of this guide is to help providers navigate these dual roles ethically and productively.

We recognize that smaller enterprises in particular—whether businesses or nonprofit organizations, and especially in rural areas—can face challenges when it comes to protecting employees’ health and safety. One of the biggest challenges is finding useful information. This short guide cannot cover all workplace risks that employees and their employers face, but one of our aims is to put the provider in the “occupational” mindset, to consider the ways in which employers can accommodate employees’ medical needs within the regulatory environment.

Every workplace is influenced by the culture of the people who work for the enterprise and the community that surrounds it. However, workers everywhere want a safe and healthful workplace, and all employers want a healthy and productive workforce. Often these goals are congruent, although sometimes they are in conflict. We have endeavored to provide a tool to promote a health- and safety-oriented culture of cooperation among workers, managers, community, and regulatory authorities.

Since the 1970 inception of the U.S. Occupational Safety and Health Administration, worker injuries and fatalities have plummeted. But there is still much we can do to support our workers’ health and their ability to work safely in the workplace and to mitigate the risk of injury to themselves or their coworkers. Managers have a primary responsibility to follow local, state, and federal laws. Beyond legal requirements, however, every enterprise manager and all workers can benefit from good
health and safety practices. Over time, healthy workers and safe workplaces avoid serious accidents, stay efficient longer, keep their best workers, and show greater value.

There should be no doubt that a healthy, motivated, and fulfilled workforce will be more productive than one that is not. Therefore, an investment in the health of the workforce is an investment in the future of the enterprise and the social fabric of our society. Working together, we can promote a safer, healthier, and a more productive workplace.

Luke P. Lee, MD, MPH, CIME, MBA, CPA
CHAPTER ONE
WHAT IS OCCUPATIONAL MEDICINE?
What is Occupational Medicine?
Andy Yorgason, DO, MPH, MHPE, FACOEM

Introduction

† A construction company is planning to do some sandblasting as part of a local building project and comes to you for help. Managers have heard something recently about a new OSHA silica standard, and they wonder what they need to do to comply.

† The volunteer firefighter department has a team member who recently was diagnosed with depression and anxiety, and is taking several medications. It is a rural department and needs every hand it can get, but the captain worries about this team member’s future as a firefighter. She calls and asks for your advice.

† A telemarketing company has had a number of neck strain complaints lately from employees. The owner wants to ensure that workers are fit for their work and has heard about other companies doing preplacement exams. He checks with you to see if you can do these exams.

† You see an elementary school janitor in the clinic. Today, she was lifting a box of tools from the floor to a rolling cart. The cart slipped forward, and as she twisted to avoid spilling the tools, she felt a twinge in her back. It continued to worsen throughout the day, and now, after work, she comes to see you.

Welcome to the world of occupational medicine—often referred to simply as “occ med.” This specialty has some of the highest satisfaction rates in all of medicine, and much of this satisfaction comes from dealing with interesting questions. I often say that in occupational medicine, we learn not just the answers to questions, but we learn how to find the answers to new questions that haven’t been asked yet.

Occupational medicine practitioners use their expertise in many settings: corporate management, academia, government regulation and enforcement, and consulting are a few examples. This basic guide for primary care providers focuses on the clinical setting, in which occupational medicine combines prevention with treatment in a very practical way.

History of Occupational Health Care

The history of occupational medicine runs parallel to the history of work, which has been around as long as humans. It can be approached from three angles: science, society, and statute. For more background on this history, I would refer you to the writings of Michael Gochfeld, MD, PhD.\textsuperscript{1,2}

Science

The science of occupational medicine starts early in medical history. In the fourth and fifth centuries, B.C., Hippocrates noted that living behaviors (activities or occupations) and locations and conditions (environments) could help predict disease. This philosophy formed the bedrock of epidemiology—the study of the distribution and determinants of disease and injury. As a medical specialty acutely focused on connecting causation of disease with work activities and environments, occupational medicine owes a great deal to these Hippocratic observations, which
would form a wellspring for occupational and environmental medicine.

Other scientific disciplines and principles that are central to occupational medicine include toxicology, nuclear physics, and ergonomics. Research in these areas has contributed to the advance of all medicine, but the combined focus of these disciplines is unique to occupational medicine.

Paracelsus introduced in the early 1500s the concept that “the dose makes the poison”, and this shaped the study of toxicology and continues to affect toxicologic evaluations today. The concept of dose goes far beyond what most people naturally associate with the term “toxicology,” comprising not only chemicals and metals, but also noise, radiation, and repetitive motions.

Bernardino Ramazzini, the “father of occupational medicine,” published his groundbreaking De Morbis Artificum Diatriba, or, Diseases of Workers, in Modena, Italy, in 1700. Remarkably, many of Ramazzini’s observations are as relevant today as they were in his time. His analysis of the connection between diseases and certain occupations included descriptions of activities those workers performed. He recommended that physicians ask about the kinds of work that their patients do. He observed that disease is connected not with chemical and physical agents, but with repetitive or forceful motions— an insight that would much later be analyzed further and termed ergonomics.

Society
At first, occupational medicine was commonly referred to as “industrial medicine.” The Industrial Revolution, beginning in Great Britain about 1760, had a profound influence on the history of the specialty, as it did on most of the rest of society. First, it prompted a major change in work activities and environments in many parts of the world. Factory work became common, and workers began interacting with machines in new ways. This revolution in the way people worked created an entirely new set of hazards that now had to be addressed. Percival Pott, an English surgeon, for example, was the first person to link scrotal cancer to the work of chimney sweeps; now we understand the carcinogen to result from combustion products in the soot that collected on the scrotums of this infrequently bathed group of workers.

Second, in tandem with changes in work itself, an entire social structure changed as many people left the countryside and flocked to cities. People who had worked relatively independently were now brought together in one workplace as they had never been before. Relationships among individuals, but particularly between workers and employers, changed tremendously. Society grappled with the challenges of the accumulation of human and industrial wastes and their detrimental effects on health. Reformers like the British Edwin Chadwick began seeking to alleviate the burdens on the suffering poor—the laboring class.

These changes in work and social structure created a class that needed a medical hero—and several came along: Charles Thackrah, Benjamin McCready, and, ultimately, Alice Hamilton (described below), to name a few.

Whereas in Europe, occupational medicine grew primarily out of social movements for improved working conditions, in the United States the roots had stronger ties to industry leadership and productivity concerns.
Several early examples of occupational medicine as practiced in the United States are provided by the industry-backed physicians hired to care for workers building railroads or toiling in mines or steel mills. The traumatic injuries they faced created a need for tailored medical care.

Employers hired physicians to fill the need. From a purely financial standpoint, there was a need to keep the workers healthy in these rural steel mill towns and work camps.

**Statute**

The changes that came about during the Industrial Revolution created the setting for the occupational medicine movement through much of the early 20th century. Social reformers exposed the injustices and hazards to workers, and several physicians played key roles in pushing legislation and policies that would motivate and create the clinical framework for the practice of occupational medicine.

In Britain, the physician Thomas Percival helped provide impetus for the Factory Act of 1802 through his description of mine conditions. It took decades, though, until any of these statutes began to make a real difference. By the Mines Act of 1842, however, Britain was making some progress in regulating workplaces, pushed in no small part by Charles Thackrah, the founder of the Leeds University School of Medicine.

In the United States, things moved more slowly. While there were important physician contributors in the late 19th century, the great advances in the field came with the monumental contributions of Alice Hamilton, particularly in the first half of the 20th century. Hamilton was the first female faculty member at Harvard. In addition to being an excellent physician and researcher, she combined a social understanding of the workers’ point of view on work and working conditions in a way that paved the way for modern occupational medicine practitioners.

The achievements of U.S. physicians and reformers such as Hamilton can be viewed through the new laws they prompted. The “grand bargain” of workers’ compensation was developed in 1911; referring to trading workers’ right to sue for employers’ presumptive liability and prompt payment for care and wage replacement. In 1936, the Walsh-Healey Act established a set of health and safety standards specific to companies working as federal contractors, creating a blueprint for future workplace safety standards.

Around this time, the organization of occupational medicine was taking hold. The American Board of Industrial Medicine and Surgery was established in 1941, and in 1948 the American Board of Preventive Medicine and Public Health was formed; the latter would later endorse occupational medicine certification.

Despite these advances, serious deficiencies in occupational and, even more significantly, environmental health existed. The fire on the Cuyahoga River in 1969 caught national attention and led to the creation of the U.S. Environmental Protection Agency (EPA) on January 1, 1970. The Occupational Safety and Health Act was signed at the end of the same year. This act set the minimum standards for most U.S. surveillance activities and for some work fitness standards and has been a reference for many other countries as well. It also established the Occupational Safety and Health Administration (OSHA) and its research partner, the National Institute for Occupational Safety and Health (NIOSH).
Since the seismic shift from that 1970 legislative action, further government advances have continued modestly. Perhaps the largest changes to occupational medicine of the past 45 years have been in the changing settings of the practice. The traditional corporate-industrial setting has moved toward more stand-alone occupational medicine clinics. Some of the corporate-aligned functions previously directed by physicians have moved to safety professionals, industrial hygienists, and nurses, while physicians perform the “medicine” in the clinics. In the past 20 years, as in other specialties, occupational medicine providers have moved into major health care organizations.

Very recently, growing concern by corporations about health care costs has led to a pendulum shift back toward onsite clinics as a potential way to control expenses and improve workers’ health. Whether to provide occupational medicine functions in the package is often included in discussions of the scope of onsite health care services. It remains to be seen whether this will be a persistent movement in occupational medicine practice.

The Many Hats of the Occ Doc

Occupational physicians wear many hats. Somewhat unlike the traditional practitioner, who is focused solely on caring for, or directing care for, the individual patient, the “occ doc” is frequently required to represent many points of view. Some practitioners are uncomfortable with this role—which requires some explanation. It may be helpful to categorize much of the work of the occ doc into three primary activities: fitness determinations, surveillance, and work-related injury care, as well as whom he or she represents with each activity. The following chart provides a good foundation for understanding the basics of occupational medicine but is not meant to be an all-inclusive list of possible functions or benefits of each activity.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Prevention or Treatment</th>
<th>Party Representing</th>
<th>Role</th>
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<td>Preplacement Exam Fitness for Duty Exam</td>
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<tr>
<td></td>
<td></td>
<td>Public</td>
<td>Evaluator of fitness for work without harm to self or others</td>
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<td>Employee</td>
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<td></td>
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<td>Employer</td>
<td>Evaluator of work-relatedness</td>
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<tr>
<td></td>
<td></td>
<td>Public via government agencies</td>
<td>Evaluator of work-relatedness</td>
<td>Causation determination</td>
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Often, when I’m asked what I do, I say that I answer these three questions:

- Are the work and the worker a good match? (Fitness determinations)
- Is the work or work environment injuring the worker? (Surveillance)
- How do I best manage an injured worker’s injury? (Work-related injury care and causation analysis)

**Fitness Determinations**

Occupational medicine providers frequently evaluate worker fitness—addressing whether the worker and the work environment match. In doing so, they help determine the worker’s level of injury risk to him or herself or to the public (including coworkers) in light of any preexisting conditions. This function can be performed in a preventive or informational visit—a preplacement, fitness for duty, accommodation, or disability evaluation exam—or during a treatment visit. Providers should consider every treatment visit another fitness for duty evaluation. And each visit should lead to the provider giving the employer an updated activity prescription.

The primary obligation of the occ doc varies; it may be to the employer (Can this skyscraper worker be productive and safe?), to the public (Does this airline pilot create risk to the public?), or to the individual (Can this worker safely perform full duties without further risk to him or herself after this work-related injury?). Frequently, there is consensus among parties as to the outcomes of these determinations. For example, it is in the interest of both an injured worker and employer for the occupational medicine provider to give an activity status report that prevents further injury.

Fitness evaluations and determinations are not without controversy. Any time a health care provider comes between an individual and the work he or she wishes to perform, there is a potential for conflict. Workers who present for pre-employment fitness evaluations not surprisingly want the provider to medically approve them. Infrequently, there is a conflict between the provider's and worker's own assessment of the risk. Particularly when there is a conflict, it is important to make fitness determinations based on published guidelines or population studies with functional and safety outcomes, when available. Examples of such guidelines and reports include National Fire Protection Association guidelines for firefighters, iv ACOEM’s Law Enforcement Officers’ guidelines, v and medical review board or medical expert panel reports from the Federal Motor Carrier Safety Association. vi Some of the challenges faced in such determinations have been highlighted in the literature, as well. vii, viii

**Surveillance**

Surveillance helps ensure that the work and work environment do not hurt the individual, other workers, or the public. In some cases, specific monitoring activities are mandated by government bodies, such as OSHA. Common OSHA surveillance activities include regular audiometric exams to monitor the effects of noise at the workplace and periodic examinations for workers exposed to lead. Surveillance does not always prevent injury in the worker being monitored. It is generally a secondary prevention screening tool, meaning it does not prevent injury but helps detect it early—ideally before symptoms or irreversible damage develop. This allows for the employer to evaluate its industrial hygiene and safety program to prevent further injury to the worker or initial injury to coworkers or the public.

The components of these activities may vary from questionnaires to physical examinations to laboratory work and imaging studies, or any combination. Many examples of surveillance activities

**Work-Related Injury Care and Causation Analysis**

When the preventive measures noted above fail, or when other circumstances lead to injury or illness, it falls on the occupational medicine provider to care for the worker. Above all, we must ensure the patient gets proper care for any complaint. However, the ongoing care we provide is typically limited to work-related injury or illness. Therefore, a critical element of the patient evaluation is to establish the causation of the complaint. If it is not deemed work related according to the laws under which you practice, the individual should appropriately and speedily be transferred to the appropriate caregiver.

When the injury or illness is work related, the occ doc can essentially become the primary care provider, coordinating treatment for that injury or illness until the individual has returned to previous status or reached maximum medical improvement (MMI), or a state where it is unlikely that significant changes will occur in the near future. In some jurisdictions, and when necessary, the occupational medicine practitioner continues to follow the patient on a periodic basis even after the patient reaches MMI.

In addition, for complex work-related cases (which tend more frequently to be illnesses than injuries), the occ doc fills the role of consulting specialist. In these cases, the providers' knowledge of causation, and the effects of work and the work environment, are essential. In these situations, occupational specialists bring expertise in areas that are not necessarily within the purview of primary care providers, such as exposure pathways, dosing, toxicology, and epidemiology, which can play important roles in these settings.

**Conclusion**

The better an occ doc understands the work activities and work environment of the population(s) being treated, the better and more precise the care and recommendations he or she can give. A great occ doc will be able to engage with the workers, management, industrial hygienists, and safety professionals as needed.

The occ doc provides a satisfying service to workers, employers, and the public through high-quality application of preventive and population health tools. For many, that satisfaction comes as we are able to apply those tools to individuals one at a time—maintaining the one-on-one touch so many of us sought in pursuing medicine as a career. At the same time, we continue to challenge ourselves by learning how to apply what we learn in each interaction to whole populations and frequently assisting employers in creating and applying policy to treat and prevent injury and illness among entire groups of workers.

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2001; 91(9): 1382.


CHAPTER TWO
CARE OF THE INJURED OR ILL WORKER
What is Occupational Medicine? Musculoskeletal Injury

James Ausfahl, MD, FAAP, FACOEM

Pain in the arm, leg, and lower back are very common work-related musculoskeletal complaints. In the arm, the cause is often either inflammation of the structures in the rotator cuff, also called impingement syndrome; lateral epicondylitis, also called tennis elbow; or compression neuropathy of the median nerve, or carpal tunnel syndrome. In the lower extremity, there are strains of the ankle and of the knee, with or without internal derangement. In the lower back, there are mechanical and neurologic issues.

Often, the first response of many clinicians to a musculoskeletal work injury is to order an X-ray. However, X-rays and other diagnostic imaging modalities are only rarely of value in work-related injury, unless there are specific red flags raised in the history or physical. In the absence of mechanical trauma or clear, relevant neurologic findings, or a history of osteoporosis or cancer, imaging the injured area is likely to reveal nothing or to find a non-work-related issue that will muddy the waters. When an X-ray identifies old and unrelated conditions, such as degenerative changes that may be irrelevant to the work injury, it can become a legal point of contention.

The most important tools in handling a musculoskeletal injury are a detailed history and a careful physical exam. Work-related injuries often occur in the context of other physical problems and can mask the presence of confounding issues. It is helpful to expand the history to look for other processes that may be referring symptoms to the area in question. ACOEM provides excellent guidelines for the diagnosis and treatment of work-related issues within their Practice Guidelines (https://www.acoem.org/PracticeGuidelines.aspx).

The History and Physical Examination

A clear understanding of the mechanism of injury directs further history gathering and focuses the health care provider on the requirements of the physical exam. It is an important tool for sorting out which symptoms are relevant to the injury and which may not be.

Not all patients presenting with work-related injuries will be able to name the incident that immediately preceded the onset of symptoms. When there is a complaint of pain or other symptoms in the absence of a clear injury, repetitive motion injury (cumulative trauma) is often considered. However, the medical literature has not adequately delineated the causes of cumulative trauma and repetitive motion injury, and thus it should be diagnosed with considerable caution.

The history should be comprehensive, including documentation of past diagnoses and injuries, current or past surgeries, and present diagnoses and medications taken. Many past or concurrent diagnoses will affect the diagnosis and treatment of a work-related injury and may also shed light on whether a complaint is truly related to work. Findings in the history may suggest the presence of a previously undetected process that may either complicate the diagnosis and treatment of the work-related complaint or explain it completely.
Examining a worker with an injury requires attention to the area of the complaint, but it should never be restricted to it. Symptoms are often referred to an area of the body from a process in another area, as can be the case in a bladder or prostate infection or in a subtle cervical disc herniation. Carefully examining areas of the body that may refer symptoms to the one in question can go a long way toward making an accurate diagnosis and returning the injured individual to productivity.

**Treatment of the Injured Worker**

Maintaining function, perhaps with restriction, should be the most important result that medical providers seek. In building a therapeutic approach to an injured worker, the priority is to focus on function rather than feeling. But despite the beliefs of the past, pain is not a reason to stay home from work; in general, being back at work and understanding that work is therapeutic will do more to relieve than aggravate the pain. To aim to eliminate all pain before returning to work is irrational and, in the long run, counterproductive.

It is the primary care provider’s role to determine an injured individual’s capabilities and return the person to the work environment with appropriate restrictions. If the workplace cannot find a job that will qualify under these restrictions, it is the employer that needs to take the injured individual out of the workforce, not the medical provider. A worker should be removed only from duties that will cause hazard to life or limb or put others at risk. It is worth noting that fewer than one-quarter (20 to 22%) of treatments for most work injuries have any support in the evidence-based medical literature.

Opioids should be used only for analgesia in very rare circumstances. Aside from the risk of addiction, it also appears that they prolong the duration of disability. Nonsteroidal anti-inflammatory drugs have been shown to be equivalent for pain relief, and in many circumstances, especially for lower back pain, to be superior to opioids in keeping pain at a level that permits function.

**Common Work-Related Musculoskeletal Injuries**

**Upper Extremity Issues**

*Shoulder impingement*  
Shoulder impingement, occasionally known as “swimmer’s shoulder,” is characterized by pain in the affected shoulder that occasionally radiates down to the mid-bicep region, with increased pain reaching above the shoulder or behind the back. Physical examination will most often show a complaint of discomfort with palpation in the lateral portion of the subclavicular space, though other areas of tenderness, including the acromioclavicular joint, may be noted. The Neer sign and the Hawkins-Kennedy test are useful to document that the issue is in the shoulder but are not specific to impingement. Initial treatment should be with anti-inflammatory medication, often for four or five weeks, with an initial restriction of lifting or reaching above the shoulder with the affected arm that is progressively reduced during the treatment. Local injection with corticosteroids has been suggested but is generally best reserved until after a trial of oral agents has shown inadequate results for three to four weeks. More recalcitrant impingement syndromes may require physical therapy.
Unless there is a history of an impact that may have caused a fracture or a history of a potentially metastatic malignancy, there is little initial use for plain films. If conservative treatment fails after several weeks, imaging to seek spurring is reasonable. The diagnosis should be confirmed by MRI of the shoulder if arthroscopic surgery is under consideration.

Tennis Elbow
Lateral epicondylitis or tennis elbow is characterized by pain in the lateral aspect of the elbow, aggravated by gripping, resisted dorsiflexion of the wrist, and resisted supination of the forearm. There is generally no actual inflammation involved; the condition represents a degenerative change in the associated tendons, with disorganized collagen deposition; it would be wiser to call it a lateral epicondylopathy. Diagnosis is through a relevant history and physical examination; imaging is not needed initially.

The treatment should focus on physical or occupational therapy; anti-inflammatory medication is of limited usefulness, except as an analgesic. Local steroid injection, once a popular approach to this diagnosis, has been found to impoverish results at one year, compared to no injection. Although restricting the use of the affected elbow can produce resolution in a few days to a week in many cases, it can take up to six months or more for some individuals to fully resolve this condition. If there is little or no improvement after about a week of restricted activity, physical therapy is the next step. Forearm straps provide some relief, presumably by unloading the affected tendon. Nighttime wrist supports are helpful as they eliminate extensor activation while sleeping.

Carpal Tunnel Syndrome
Carpal tunnel syndrome is a compression neuropathy of the median nerve, occurring as the nerve passes under the ligament forming the roof of the carpal tunnel at or near the base of the thumb. Pain or numbness in the palmar surface of the thumb, index finger, and lateral part of the middle finger, and of the lateral portion of the palm, sparing the thenar eminence, is characteristic; but, it is not uncommon for only a portion of the area for which the median nerve provides sensation to be involved. Occasionally, the median nerve may supply sensation to the whole palmar surface of the hand, again sparing the thenar eminence.

Phalen’s and Tinel’s signs are often positive on physical examination. Notably, carpal tunnel syndrome can be a result of hypothyroidism, obesity, rheumatoid arthritis and diabetes mellitus rather than work activities. Even if the work activity is the cause of the syndrome, these other conditions can and do aggravate the syndrome and potentially delay recovery. If any of these comorbidities is present, it is important to ensure that they are well controlled. Unless the carpal tunnel syndrome is severe, nighttime splinting may resolve the problem, often combined with an oral anti-inflammatory. Local corticosteroid injection has been suggested, as well, though its effect is generally short term. If nocturnal splinting fails to resolve the symptoms after three to four weeks, physical therapy is often quite effective. If these approaches do not produce good results, a nerve conduction test can be considered; surgical intervention should be suggested only after a failure of more conservative measures.

Lower Extremity

Ankle Strain
Ankle strains characteristically occur after trauma, such as forceful inversion or eversion of the ankle, and show local pain and swelling. Technically, a sprain involves stretching of a tendon or
ligament without significant tearing; a sprain is associated with tearing. Unless there is instability of the ankle, differentiating the two is difficult and generally does not change the treatment. Imaging is not likely to be of value unless 1) there is point tenderness on palpation of the posterior aspect of the distal 6 centimeters of the fibula or tibia or at the tip of the malleolus, 2) the patient cannot take four steps immediately or at the time of exam, 3) there is point tenderness at the base of the fifth metatarsal or the navicular, or 4) the patient is elderly or has potentially metastatic cancer or osteoporosis. The RICE acronym applies: rest the affected area, ice it for the first 24 to 36 hours, externally compress it with either an elastic bandage or support it with a stirrup or clamshell splint, and elevate it.

Knee Strain With and Without Internal Derangement

Knee strains occur after trauma, through falls or lateral or twisting force, resulting in stretched tendons or ligaments and local pain and swelling. Imaging is generally not useful unless there is 1) tenderness of the head of the fibula, 2) isolated tenderness of the patella, 3) inability to flex the knee more than 90°, 4) inability to bear weight for four steps immediately and at the time of exam, or 5) if the worker is over 55 years of age. Signs of laxity of the knee are of concern, possibly indicating ligamentous tears, as is a history of the knee locking, possibly indicating a meniscal tear. Pulses in the foot are an important sign: in dislocations, the popliteal artery can be occluded, which requires more emergent intervention. Presence of an effusion is worthy of note but may not be of great help diagnostically. Rest and ice for the first 24 to 36 hours, followed by intermittent heat and support, is the best treatment. Toe or foot pumping exercises are suggested during this time frame to reduce the risk of deep venous thrombosis. If there is concern about knee stability, bracing may be of some value. Acetaminophen or an anti-inflammatory medication is generally all that is needed for the pain, and careful follow-up with reassessment of the knee function and stability is important. Instability or locking demonstrated on examination and lasting more than four weeks raises the potential of a complete ligament tear and may call for an MRI. Unless surgical repair is under consideration, there is little reason for further imaging.

Spine

Mechanical Versus Neurological Problems

Back pain, particularly lower back pain, is among the most common work-related complaints. It is also potentially among the most expensive. A careful history of the injury is important but does not always produce a clear mechanism of injury. Several findings are “red flags” that may indicate a more serious disorder. The popular mnemonic TUNAFISH indicates potentially more serious disorders that call for imaging:

T – Trauma
U - Unexplained weight loss
N - Neurologic symptoms (dermatomally distributed pain, or loss of bowel/bladder control)
A - Age > 50
F – Fever
I – IV-drug use
S - Steroid use
H - History of cancer
Back pain that does not show a dermatomal pattern, or that does not extend below the elbow or the knee, is generally not neurologic in origin. Certainly, the physical examination should screen for disc disease with a careful neurologic exam, including LeSégue’s sign, Spurling’s maneuver, and screen for meningismus as well as muscle strength and deep tendon reflexes. Unless there is a clearly palpable muscle spasm, treatment should consist of initial cold compresses for 20 minutes or so every four hours while awake for the first 24 to 36 hours, followed by moist heat in the same rotation; acetaminophen or an anti-inflammatory for pain; and continued work with reduced lift, twist, push-pull, and bending. Close follow-up is important, with progressive reduction of the restrictions. If these conservative measures fail to produce improvement in two weeks, the next step is to initiate physical therapy. Only after four weeks of conservative treatment, with at least two weeks of physical therapy, have failed to produce adequate results should imaging be considered, unless the “red flags” above appear. Unless there is clearly palpable muscle spasm, muscle relaxants appear to have little or no value, and even when there is active spasm noted, they are rarely of value for more than about 7 to 14 days.

**The SPICE Model: A Guide to Treatment**

In handling an injured worker, remember the acronym SPICE, and let it be a guide in diagnosis and treatment.

**Simplicity**
Keep the treatment and diagnosis simple; the simpler the label and the focused the treatment, the more likely and sooner the worker will be able to return to full duty. A complicated diagnosis or complex treatment regimen generally delays returning to work and decreases the chance that the worker will return. Prolonged periods of time completely off work tend to generate both physical and mental issues that ultimately inhibit a return to gainful employment.

**Proximity**
Keep the individual as close to the work environment as possible. Ideally, limited duty should be assigned near the location of normal duty, if not at the usual workstation. Physical therapy or other interventions should be planned to allow the injured worker to be at the workplace when he or she is not being treated. Those who share the workplace often form important social networks, and keeping a worker in that environment provides support toward recovery. This support improves the injured worker’s morale and motivation, and often that of coworkers.

**Immediacy**
The injured worker should be seen and treated promptly. The more time that elapses before treatment, the more time the worker has to become focused on the problem, potentially adding psychological barriers to returning to work. It also weakens or breaks emotional and social bonds with the others in the workplace, reducing the will to return. Psychosocial issues can be major roadblocks to returning to work.

**Centrality**
One individual health care provider should be the central person responsible for care of the worker’s injury and ensure that all involved share the common goal of restoring the injured worker to full function. The health care provider is uniquely able to fill this role but must be willing to communicate clearly with all parties involved.
**Expectancy**
All too often, injured workers see their situation as a catastrophe that will end their ability to work. This is only rarely the case, and from the start, the injured worker should be coached to see the goal as a return to full duty at the same, or perhaps even better, capacity as before the injury.

Setting that expectation can go a long way toward building a worker’s confidence in his or her ability to return to work. Equally important, the clinician needs to realize that occupationally related injuries will often require longer periods to achieve full recovery, but the clinician also needs to be alert to excessive prolongation of therapy, which often indicates the possibility of an unnoticed, additional confounding problem.

**Encouraging Return to Work**
Research shows that worker injuries compensated by workers’ compensation take longer to heal compared to injuries whose cost falls on the patient. The reasons are several. First, the patient may take on a victim mentality: upset at the injury, he or she may feel that he or she has a “right” to be taken care of. Second, the compensation system itself encourages worker to stay injured: light-duty assignment may pay the worker less than his or her income staying at home. This pay for reduced or no work sets up a strong disincentive to return to regular work. Therefore, the treating medical provider should be aware of these built-in factors and encourage the patient, supervisor, and all involved to expect the worker’s return to work as soon as is medically prudent.
Infections
Manijeh Berenji, MD, MPH

Many workers are at risk of developing occupational infections, including those employed in the health care, agricultural, construction/demolition, and sanitation sectors. The most common primary infections that present to the primary care health care provider in the scope of a work exposure or illness are superficial wound infections (such as cellulitis), followed by respiratory infections. Secondary infections can occur, depending on the mechanism of injury or illness and complications, because of underlying comorbid conditions in the injured worker. Examples include the systemic dissemination of an infectious agent(s) after an injured worker sustains a complex injury to bone or soft tissue or pulmonary compromise (such as pneumonia) after an inhalation exposure. Understanding the work-related exposures that contribute to these infections requires special attention because they pose unique challenges to patient care and safety in the workplace.

Types of Infectious Agents

Bacterial, viral, fungal, protozoan, and parasitic agents are the most common sources of occupationally derived infectious diseases. Prions (proteinaceous infectious particles that do not have genes and are able to replicate in humans) can also cause infections in the work setting, albeit rarely.

Health care workers are susceptible to a number of infectious agents, primarily bacterial and viral (see Table 1).

Table 1: Infectious Agents that Can Be Acquired by Health Care Workers

<table>
<thead>
<tr>
<th>Bacterial</th>
<th>Viral</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Acinetobacter baumannii</em></td>
<td>Hepatitis A</td>
</tr>
<tr>
<td><em>Burkholderia cepacia</em></td>
<td>Hepatitis B</td>
</tr>
<tr>
<td><em>Clostridium difficile</em></td>
<td>Hepatitis C</td>
</tr>
<tr>
<td><em>Clostridium sordellii</em></td>
<td>Human immunodeficiency virus (HIV)</td>
</tr>
<tr>
<td><em>Pseudomonas aeruginosa</em></td>
<td>Norovirus</td>
</tr>
<tr>
<td><em>Escherichia coli</em></td>
<td>Influenza</td>
</tr>
<tr>
<td><em>Mycobacterium tuberculosis</em></td>
<td>Vancomycin-resistant enterococcus</td>
</tr>
<tr>
<td><em>Mycobacterium abscessus</em></td>
<td>Vancomycin-resistant Staphylococcus aureus</td>
</tr>
<tr>
<td><em>Carbapenem-resistant Enterobacteriaceae</em></td>
<td>Methicillin-resistant Staphylococcus aureus</td>
</tr>
</tbody>
</table>

Among bacterial agents, *Mycobacterium tuberculosis* (which causes tuberculosis) is a widely recognized occupational infectious hazard among health care workers. Those health care workers employed in low- and middle-income countries with a higher prevalence of the disease, and those who treat vulnerable patient populations (including those with immunocompromised states) in the United States are at higher risk of acquiring the bacterium while on the job. With respect to viral agents, health care workers are prone to exposure to HIV and hepatitis C, depending on the type of work they do. Physicians, physician assistants, nurses, phlebotomists, and those doing invasive
procedures with increased exposure to infected patients’ bodily fluids (via droplet or percutaneous routes) are more susceptible.

Agricultural workers, particularly those who work directly with animals, are more prone to zoonotic diseases, transmitted to humans from wild or domestic animals and bird species, and to arboviruses, transmitted to humans from arthropods such as ticks and mosquitoes through an animal host. Table 2 lists examples of prevalent bacterial and viral agents that can cause zoonotic diseases.

Table 2: Infectious Agents that Can Be Acquired By Agricultural Workers

<table>
<thead>
<tr>
<th>Bacterial</th>
<th>Viral</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Bacillus anthracis</em></td>
<td>Avian influenza</td>
</tr>
<tr>
<td><em>Mycobacterium bovis</em></td>
<td>Rabies</td>
</tr>
<tr>
<td><em>Brucella melitensis</em></td>
<td>Arboviruses (West Nile, Zika)</td>
</tr>
<tr>
<td><em>Brucella abortus</em></td>
<td></td>
</tr>
<tr>
<td><em>Cryptosporidium parvum</em></td>
<td></td>
</tr>
<tr>
<td><em>Giardia duodenalis</em></td>
<td></td>
</tr>
<tr>
<td><em>Leptospira interrogans</em></td>
<td></td>
</tr>
<tr>
<td><em>Chlamydia abortus</em></td>
<td></td>
</tr>
<tr>
<td><em>Chlamydia pecorum</em></td>
<td></td>
</tr>
<tr>
<td><em>Chlamydia psittaci</em></td>
<td></td>
</tr>
<tr>
<td><em>Coxiella burnetii</em></td>
<td></td>
</tr>
</tbody>
</table>

In the construction and demolition industries, the main causes of occupational-related infections are bacterial (*Clostridium tetani*) and fungal (*Aspergillus, Histoplasma, and Coccidioides* species).

Sanitation workers, including sewage and wastewater workers, are vulnerable to bacterial (including *Helicobacter pylori* and *Leptospira* species) and viral (primarily hepatitis A) infectious agents.

**Mechanisms of exposure**

Front-line health care workers, such as physicians, nurses, nursing care assistants, technicians, clinical laboratory workers, first responders, and autopsy personnel, can be exposed to infectious agents through contact, droplet, and airborne routes. Contact exposures can happen directly—when the worker touches a patient’s body fluid through non-intact skin or suffers an accidental needle stick—or indirectly, when the worker touches a contaminated item or surface.

Examples of contact-transmissible infectious agents in the health care setting include Methicillin-resistant *Staphylococcus aureus* and Vancomycin-resistant enterococcus. A health care worker can be exposed to droplet-containing infectious agents when an infected person coughs, sneezes, or speaks or during medical procedures (including suctioning or endotracheal intubation). Disease can develop when these droplets reach the worker’s eyes, nose, or mouth. Influenza and *Bordetella pertussis* are two examples of droplet-induced infections that can arise among this cohort of workers. Airborne transmission occurs through very small particles that stay intact and disseminate (as opposed to droplets, which are too large to travel long distances). *Mycobacterium tuberculosis* is one disease that occurs in health care personnel regardless of face-to-face contact with an infected patient. It is spread via droplet nuclei (1 to 5 microns in diameter) when people with
pulmonary or laryngeal tuberculosis cough, sneeze, shout, or sing. Depending on the environment, these tiny particles can remain suspended in the air for up to several hours.

Farmers, ranchers, veterinarians, meatpackers, animal breeders, animal researchers, and others in the agricultural field can be exposed through direct contact with animals or birds (through bioaerosols or percutaneously), through their byproducts (such as manure or placenta), through an animal or bird bite, or through inadvertent oral consumption of raw meat or milk. They can also become indirectly infected by contact with contaminated soil, food, or water.

For construction and demolition workers, activities such as digging, drilling, and excavating can stir up the naturally occurring bacterial and fungal inhabitants of soil, water, and vegetation. In the case of tetanus, the bacteriumClostridium tetanienters the body through a wound or cut in the worker’s skin. Fungal spores are resistant to desiccation and thus can survive for years. When they become airborne, these spores can remain suspended in the air for long periods, traveling far from their origins.

Sanitation workers face three main modes of occupational exposure:

- hand-to-mouth contact, which can occur during eating or drinking, or wiping the face with contaminated hands or gloves
- skin contact, through cuts, scratches, or percutaneous sticks
- oral intake of dust/aerosols

**Treatment**

Appropriate treatment depends on the nature of the organism and manifestation of disease. It can include antibiotic, antiviral, antifungal, or other treatment modality, via oral or intravenous routes. There are many infectious disease guides for the primary care health care provider, including Sanford Guide to Antimicrobial Therapy, Epocrates, UptoDate, and PubMed. In more complicated cases, consultation with an infectious disease specialist is advised.

**Return to Work Considerations**

It is important for the primary care health care provider to pay careful attention to the patient’s return to work to avoid the potential for complications, including secondary infection. In the case of an injured worker with a burn injury for instance, the primary care health care provider should not send the worker back to work if there is a high probability that the dressing can become compromised through moisture or dirt. However, there are multiple socioeconomic reasons for workers to stay engaged with their workplaces, including full-wage compensation as opposed to limited worker’s compensation. Therefore, the treating provider is encouraged to provide employers with specific work restrictions, such as “must keep dressing dry,” or “no use of left hand” (in the event of a hand infection) and so on. Many states’ workers’ compensation treatment guidelines require medical providers to specify job restrictions and avoid blanket “no work” orders, because many employers offer limited duties or temporary job transfers. After an inhalation exposure has been treated successfully, it is best not to return the worker back to the same work environment if there is a high risk for inhalation of vector particles, because that could lead to secondary infection down the line, such as pneumonia.
Prevention

The Centers for Disease Control and Prevention issues protocols for workers and primary care health care providers in case of blood-borne pathogen exposures (hepatitis B and C, and HIV). These protocols address the use of proper personal protective equipment and how to report needle stick and other bodily fluid exposures.
Respiratory Disease
Amir Nicknam, MD, MPH

It is imperative for primary care providers (PCPs) to recognize and address occupational-related respiratory diseases in the primary care setting. These diseases are those caused or exacerbated by various work factors. This section addresses management of toxic inhalation exposures, occupational asthma, pneumoconiosis, and occupational lung cancers.

Assessment of occupational respiratory diseases requires full attention to the patient’s job description, signs, and symptoms and awareness of occupational concerns that require screening. While caring for such a patient, PCPs should obtain a detailed history, conduct a thorough physical exam, order correct imaging, and conduct pulmonary function testing (PFT).

Evaluation

The occupational history should include the types and duration of exposure to hazardous materials as well as a review of occupational environmental controls and protective respiratory equipment used. In accordance with OSHA, Material Safety Data Sheets (MSDS) should be provided by the employer (although in practice the employee often brings them to the clinic).

Providers must perform thorough physical exams on all patients with possible concerns about occupational exposure. If lung disease is suspected, PCPs should also consider ordering PFTs and imaging such as chest X-rays (two views) or chest CTs. A high-resolution CT scan is recommended over conventional CTs if it is available, because its increased sensitivity can help assess the presence, character, and severity of a variety of diffuse lung disorders.

Pulmonary Function Test
For PFT interpretation, PCPs should follow these steps:

1) Calculate the FEV₁/FVC ratio.
2) Calculate the FVC value.
3) Confirm the obstructive or restrictive pattern.
4) Grade the severity of the abnormality.
5) Determine reversibility of the obstructive defect.
6) Perform a bronchoprovocation test if indicated.
7) Establish the differential diagnosis.

Peak Expiratory Flow Rate Meter
The PEFR meter is a mobile pulmonary device that the patient uses at home, which can detect changes in airway obstruction. A 20% or greater variability in PEFR is an asthmatic response.

Toxic Inhalation Exposure

Screening
Toxic inhalation injuries can occur following industrial, transportation, or fire-related accidents. PCPs must identify the offending gas, duration of exposure, and presenting symptoms. Water-soluble toxins can cause local irritation of conjunctival membranes and upper airways, hoarseness,
cough, and bronchospasm. In contrast, water-insoluble toxins are absorbed more distally in the airways and can penetrate the alveoli. If a patient is not screened or treated properly, he or she may develop bronchiectasis, bronchiolitis obliterans, or even persistent asthma. In addition, chemical laryngitis must be ruled out if a patient presents with a badly burned nose or throat, hoarseness, or stridor.

**Evaluation**
PCPs must assess whether a patient is hemodynamically stable before taking an occupational history, performing an examination, or ordering spirometry or peak flow to measure the degree of the airway obstruction. Providers should consider performing a chest X-ray immediately post-exposure. In some cases, patients who have inhaled a toxic agent have an increased risk of developing chemical pneumonitis or pulmonary edema within four to eight hours of a heavy exposure. PCPs should know that a patient who arrives in the medical office after inhaling a poorly water-soluble agent (such as nitrogen oxide or phosgene) may lack any respiratory distress signs initially but needs to be monitored for a minimum of 24 hours.

**Treatment and Prevention**
The best treatment is primary prevention through measures such as using recommended personal protective equipment (PPE) and education. While assessing the patient, PCPs should consult the MSDS obtained from the employer for any inhaled toxin. PCPs should treat symptomatic patients with bronchodilators (beta agonist and/or steroid) and sometimes with parenteral steroid intramuscular injection in the office. Immediate decontamination of exposed cutaneous and conjunctival areas is very essential. PCPs should consider oxygen treatment for patients with severe burns, including facial burns, and transfer them to a hospital for direct laryngoscopy or fiberoptic bronchoscopy to rule out laryngeal edema.

Stable patients can be managed in the outpatient setting with medications (inhalers and/or steroid), serial periodic physical examinations, spirometry and/or peak-flow volume measurements, chest X-rays, and pulse oximetry. PCPs should familiarize themselves with the OSHA regulations specifically related to some of these exposures and related medical requirements.

**Occupational Asthma**

**Screening**
Occupational asthma occurs in patients who have airway obstruction and/or hyperresponsiveness to an agent in their workplaces. A variety of airway obstructions can occur through various mechanisms, such as immediate hypersensitivity, direct-airway irritation, and/or inflammatory processes. Occupational asthma is broken down into two subcategories: sensitizer-induced asthma and irritant-induced asthma. Sensitizer-induced asthma is characterized by certain agents that might be present in a work environment, causing sensitization to occur. Irritant-induced asthma occurs after substantial exposure to dust, vapor, or fumes without a latent period. Irritant-induced asthma can lead to reactive airway dysfunction syndrome (RADS) when short-term, high-intensity exposure occurs.

**Evaluation**
PCPs should consider occupational asthma if a patient has noticed symptoms that occur only while at work or occur regularly after work, or that improve over prolonged periods away from work (such as on weekends or vacations). On physical examination, if a patient with suspected
occupational asthma is not in the midst of an acute exacerbation, he or she may appear normal. Chest X-rays also will usually be normal but in acute exacerbations may reveal hyperinflation and flattening of the diaphragm. Chronic inflammation due to occupational asthma may reveal fleeting infiltrates due to mucus plugging and bronchial wall thickening.

Spirometry is the most reliable method for assessing airway obstruction. A 12% percent improvement of the FEV$_1$ of at least 200 mL after administration of a bronchodilator is an indication of hyperresponsive airways. Monitoring serial peak expiratory flow rate over a period of weeks to months is the most efficient way to document work-related asthma, because it can detect late responses that occur after work. Methacholine or histamine challenge is used when spirometry readings are normal. Allergy skin tests are performed to rule out atopic asthma, which increases the risk for high-molecular-weight sensitizer-induced asthma.

**Treatment**
Primary intervention includes removal or reduction of the offending agent in the work environment with routine follow-up for monitoring of lung function and nonspecific airway responsiveness. Patient education and use of PPE are essential to prevent future exacerbations, as are job-engineering changes, which can potentially be arranged through discussions with the employer.

**Pneumoconiosis**

**Silicosis**
Silicosis is a parenchymal lung disease caused by inhalation of silicon dioxide, also called silica, which is found in rocks and sand. It particularly affects miners, sandblasters, foundry workers, tunnel drillers, quarry workers, stone carvers, ceramic workers, and silica flour producers. Patients with chronic silicosis can develop silicosis nodules in the pulmonary parenchyma and hilar lymph nodes as well as progressive massive fibrosis (PMF). Chronic silicosis increases patients’ risk for typical and atypical mycobacterial diseases and fungal diseases such as cryptococcosis and coccidioidomycosis.

Diagnosis of silicosis is typically made using chest X-rays that reveal an “eggshell” pattern and/or small round opacities < 10 mm in diameter in both lung fields. In patients with simple silicosis, PFT may reveal a mild restrictive pattern with decreased lung compliance or mild obstruction as well as reduction in lung volume, decreased defusing capacity of the lung for carbon monoxide (DLC), and hypoxemia with exercise. There is no effective treatment for silicosis; patient management is focused on stopping the progression of the disorder by ending the exposure.

**Asbestosis**
Asbestosis is a diffuse interstitial pulmonary fibrosis caused by inhalation of asbestos fibers, which typically deposit at the bifurcations of the conducting airways and alveoli. The history should include the type and size of the fiber, intensity and duration of the exposure, history of cigarette smoking, and individual susceptibility to asbestosis.

During auscultation over the posterolateral chest in the middle-to-late phase of aspiration, bibasilar crackles with a “Velcro” quality may be heard, and are unaffected by coughing. A chest X-ray may show small, irregular, or linear opacities distributed throughout the lung fields or loss of definition of both the heart border and hemidiaphragms. Asbestosis, unlike most other pulmonary fibroses, may display bilateral pleural thickening. Detection of early asbestosis is done through
diaphragmatic or pericardial calcification on imaging studies—of which high-resolution CT scan of the lungs is the most sensitive for early detection. PFTs may show restrictive impairment with a decreased DLCO score. There is no current treatment for asbestosis; management is the same as it is for silicosis.

Malignant mesothelioma is a rare pleural tumor that arises in 80% of asbestos-exposed workers. A chest radiograph is performed to identify whether there is pleural effusion without contralateral shift of the mediastinal structures. Chest CT will often show thickened pleura with a distinctive irregular nodular internal margin. Pleural fluid analysis and lung biopsies are used for diagnostic confirmation. Special stains and/or electron microscopy are also typically required. PCPs must refer patients with these conditions to pulmonary and oncology specialists for further evaluation and treatment. Radiotherapy, chemotherapy, and surgical management can be attempted; however, there has been no evidence of improvement of quality of life or prolongation of the patient’s survival.

**Coal Workers’ Pneumoconiosis**

Coal Workers’ Pneumoconiosis (CWP) is a parenchymal lung disease. Coal miners typically come into the clinic with mild to severe respiratory symptoms with significant impairment. This disorder can lead to PMF, which results in respiratory insufficiency and death if not managed properly.

A chest radiograph in a patient with simple CWP will show small round opacities of < 10 mm in the lung parenchyma in the upper lung zones. The condition will advance to the lower lung zones at later stages. As CWP progresses, PFT may reveal either a restrictive or mixed restrictive and obstructive pattern.

There is no effective treatment for CWP. The incidence of pneumoconiosis was reduced significantly after the 1969 Coal Mine Health and Safety Act, which established programs to monitor dust levels in mines and radiographic surveillance of miners.

**Pulmonary Cancers**

Cigarette smoking is the most important preventable cause of lung cancer; however, occupational and environmental causes are also preventable. Known lung carcinogens include but are not limited to: asbestos, arsenic, chloromethyl ethers, chromium, metals, radon, environmental tobacco smoke, mustard gas, nickel, and polyaromatic hydrocarbons. Patients who have a history of both asbestos exposure and cigarette smoking have a much greater risk of developing lung cancer.

Chloromethyl ethers are highly carcinogenic alkylating agents that can damage DNA. Arsenic is found in occupations involving smelting, pesticide manufacturing, and other industrial work. Inert gases such as radon are decay products of uranium-235 found in occupations such as uranium and other underground mining. Although not commonly thought about within the context of occupational exposures, radon is the number two cause of lung cancer. Exposure to radon and cigarette smoke act synergistically in this process.

Small-cell carcinomas are the most common lung cancers found among uranium miners.

Although this section provides an overview of the chief occupational-related respiratory illnesses, there are many factors that affect workers’ respiratory health in specific industries and settings. To understand more about these additional factors, providers may seek resources available from
OSHA and the National Institute for Occupational and Safety Health.
Toxic Exposures
Beth Baker, MD, MPH, FACMT, FACOEM

What is Toxicology?

People can be exposed to toxic substances at the workplace, at home, or in the environment. Some patients may present at the primary care provider’s office with hidden symptoms that turn out to be related to toxic exposure. Others know they were exposed to a particular compound at work or think that their symptoms might have something to do with their jobs. Whether working in a foundry, chemical plant, fast food restaurant, or office environment, toxic exposures can be the cause of symptoms.

Toxicology involves the identification, management, and prevention of harmful effects from chemicals, radiation, or biological hazards on human and other living organisms. Paracelsus (1493–1541), the father of toxicology, recognized that “the dose makes the poison.” Some substances that can be toxic at high exposure levels may cause no effect at low levels. For example, exposure to high levels of inhaled formaldehyde may cause new headache, nausea, and vomiting; whereas, lower levels may not cause any symptoms in the majority of those exposed. However, the same low levels of formaldehyde exposure may cause sensitization in some individuals, resulting in allergic contact dermatitis. Toxicity may also vary based on the intrinsic toxicity of the substance, route of exposure, amount absorbed, or amount metabolized or excreted.

History and Exposure Documentation

When evaluating a patient with concerns about a toxic exposure, it is important to take a thorough symptom history and to understand when and how the individual was exposed. For a chemical or hazard to cause a toxic effect, it needs to have direct contact with the individual or be absorbed into the body in sufficient quantities. Many occupational exposures such as silica (found in industries ranging from road construction to foundries) or beryllium (used in many industries, such as airplane parts) occur through inhalation and, less commonly, through ingestion or dermal exposure.

Once a toxic exposure is documented, the provider must determine whether the patient develops new symptoms or significant aggravation of symptoms consistent with that exposure. Multiple online resources, such as Toxnet or PubMed, can help providers identify the adverse health effects of, or symptoms likely to be caused by, a chemical or substance at a particular dose and route of exposure. Local poison control centers, occupational medicine physicians, and medical toxicologists also serve as resources.

Measurement Principles

The concentration of certain substances, such as lead, in the environment can be measured in samples such as air or water by an industrial hygienist or other specialist. If the exposure is recent or ongoing, some chemicals can also be measured in individuals’ blood or urine, which may be better markers for determining levels of exposure and health effects. For example, a blood lead level is the best biomarker for confirming acute lead health effects. Other chemicals, such as benzene, a solvent, are cleared so rapidly from the body that blood levels are not helpful.
These environmental exposure levels can be compared to permissible exposure levels (PELs) issued by the Occupational Safety and Health Administration (OSHA) or exposure guidelines produced by the Environmental Protection Agency. Occupational medicine physicians and industrial hygienists work with employers to minimize exposure in the workplace. In one instance, I was working with employees who had elevated lead levels and signs of lead toxicity as a result of manufacturing lead sinkers used in the fishing industry. When I called the company’s attention to the problem, it switched from using lead to zinc.

**Exposure Mitigation**

Companies can mitigate toxic exposures in a variety of ways. Most directly, they can replace toxic substances with less toxic substances. They can also institute engineering controls, such as building enclosures around hazardous processes. These are generally better methods of exposure control than administrative measures (such as better clean-up procedures or job rotation) or personal protective equipment (PPE), which requires the employee to change his or her behavior. Once a toxin has been identified in the workplace, a variety of controls can be put into place to ameliorate its effects: Depending on the chemical, workers may use PPE such as gloves or respirators, for example.

**Types of Toxic Exposures**

**Irritant Gasses**

Exposure to irritant gasses, such as chlorine or ammonia, may cause eye, nose and throat, or skin irritation or shortness of breath. Symptoms are dose related, and higher-intensity exposure for longer durations results in greater toxicity. Most of the OSHA PELs are set to avoid chemical irritant effects, and exposure at levels below the OSHA PEL typically will not cause irritant symptoms. Still, at high-level exposure, highly water-soluble gases such as ammonia and sulfur dioxide cause upper respiratory symptoms. They dissolve quickly on mucosal surfaces and are filtered by the nose or upper airways.

Gasses with low water solubility, such as nitrogen dioxide and phosphine, are more likely to enter the bronchioles and alveoli and can cause acute lung injury without accompanying upper respiratory symptoms. However, extremely high-level exposure to ammonia and sulfur dioxide may also cause lower respiratory symptoms. Large particles > 10 microns tend to be filtered by the upper respiratory tract; small particles are more likely to reach the alveoli. Some gases, such as carbon monoxide, hydrogen sulfide, and cyanide, may cause significant systemic toxicity without any irritant effects.

**Metals**

Metals such as lead, beryllium, manganese, arsenic, and others may cause a variety of symptoms. Acute arsenic exposure can cause multisystem effects including gastrointestinal complaints, hypotension, and cardiac or neurologic effects. Chronic arsenic exposure has been associated with multiple health issues, including skin hyperpigmentation and hyperkeratosis; peripheral neuropathy; increased cardiovascular mortality; and skin, lung, and bladder cancers. Beryllium exposure, commonly found in advanced electronics and aerospace manufacturing, may cause acute irritant symptoms and chronic berylliosis with dyspnea and lung infiltrates. Lead is readily absorbed through inhalation and ingestion. Children are more susceptible to low-level lead poisoning, which
can cause cognitive and developmental delays.

High-level acute lead exposure may result in multiple symptoms including abdominal pain, nausea and vomiting, headache, confusion, encephalopathy, seizures, abdominal pain, and constipation. High-level inhaled acute mercury exposure may cause cough, dyspnea, mouth irritation, and gastrointestinal complaints.

**Solvents**

Solvents are used in many commercial products and industries, particularly in manufacturing operations where these liquids are used for cleaning. Because solvents are volatile, the major route of exposure is inhalation. Toxicity typically depends on lipid solubility and affects lipid-rich tissue such as that found in the brain and nervous system. High-level acute exposure causes acute solvent syndrome with symptoms similar to acute alcohol intoxication. Some solvents, such as carbon tetrachloride or trichloroethylene, may cause liver damage. Benzene exposure may cause aplastic anemia, myelodysplasia, and leukemia.

**Radiation**

Radiation is typically divided into nonionizing or ionizing radiation. High-dose exposure to nonionizing radiation, such as microwaves, causes thermal injury such as skin burns and eye watering or a gritty sensation. Ultraviolet radiation can cause photo conjunctivitis in welders (called flash burn or welder’s flash), as well as cataracts, sunburn, actinic keratosis, basal cell carcinomas, squamous cell carcinomas, and malignant melanoma. High-level acute exposure to ionizing radiation, as happened after the 1986 explosion of a nuclear reactor at Chernobyl, Ukraine, in the former Soviet Union, causes a dose-dependent acute radiation syndrome. Chronic effects may occur from excessive cumulative exposure.

**Patient Evaluation**

Workers may present with symptoms and report potentially associated toxic exposures. In evaluating such patients, providers should be aware of certain diagnostic pitfalls. One of those pitfalls is overreliance on the reported cause: Examples include diagnosing photo conjunctivitis while missing possible bacterial conjunctivitis as the true cause, or diagnosing a patient with viral gastroenteritis when the patient has been exposed to high-dose arsenic. Providers should remember to “do no harm” when confronted with a potential toxin that he or she is not very familiar with. Keeping Paracelsus in mind ("the dose makes the poison"), providers should remember that incidental exposure or very low-dose exposure to most toxins is usually harmless. However, the reported exposure should be documented, symptoms evaluated, and the toxin researched by the provider to determine whether these symptoms could be due to the exposure at the dose reported. Following this evaluation, providers may end up reassuring the patient that a single, very low-dose exposure to a particular toxin is harmless. Failing to reassure the patient of the dose-response relationship can cause undue stress for the patient.
Occupational Skin Diseases

Occupational skin conditions are those that occur at the workplace or worsen because of exposures there. Such exposures include:

- irritants, both physical (heat, water, radiation, friction) or chemical (acids, bases, metals, and other agents)
- allergens (certain metals and proteins such as animal dander)
- infections (fungal, viral, or bacterial)

Contact dermatitis comprises more than 95% of occupational skin diseases. The rest are acneiform diseases, cancer related, disturbances of pigmentation, infections, or allergic skin reactions. The most common types of contact dermatitis are allergic contact dermatitis, irritant contact dermatitis, and contact urticaria.

Epidemiology of Occupational Skin Diseases

Occupational Skin Disease (OSD) consistently accounts for approximately 35 to 40% of all occupationally acquired illnesses, affecting about one in every 1,000 workers. The incidence and prevalence of occupational dermatosis is slightly more among men (roughly 59%) than women (41%), with the highest rate occurring among 25- to 39-year-olds (about 39%). Nursing aides and orderlies, and janitors and cleaners, are the two types of workers with the most cases. They are involved in wet work: the direct and frequent exposure to water, as well as exposure of hands to wetness for more than two hours daily, is associated with irritant contact dermatitis. It also may make it easier for allergens to penetrate the skin.

Among the OSDs, allergic contact dermatitis is the largest cause of total temporary disability and is the costliest relative to occupational rehabilitation. Contact dermatitis (also known as eczema) has costs associated with both treatment and partial permanent disability.

Obtaining a comprehensive exposure history, including potential exposures at work and outside of work, can help in the management of dermatological conditions.

Occupational Skin Conditions: An Overview

Occupational skin conditions usually result from an exposures to irritant or allergic agents. The agent, its amount, length of and frequency of exposure, whether the worker uses personal protective equipment, and the individual’s susceptibility play a role in the development and severity of the condition. As the name implies, contact dermatitis—both irritant and allergic--results from exposure to an external agent that is able to penetrate the skin barrier.

Irritant contact dermatitis (ICD) is the most prevalent occupational skin condition. Acute ICD can result from exposure to strong acids or alkali, resulting in superficial—not deep—burns, and from direct exposure to ionizing radiation sources. Chronic ICD usually results from prolonged exposure
to mild or weak irritants such as water (especially affecting health care workers, hairdressers, barbers, janitorial staff); cleaning agents, petroleum products, cutting fluids, abrasions, solvents, and metals (including arsenic and chromium); or mechanical friction, for example from wearing and removing surgical gloves. The process is accelerated with exposure to higher doses of the irritant agent or when one is exposed to a combination of irritants. Allergic mechanisms are not involved in the development of ICD.

In the acute phase, workers’ symptoms and clinical signs vary from transient redness and mild discomfort to skin sloughing and intense pain. Chronic presentation may show localized, well-demarcated areas of dryness, cracking, and gravitational dripping of the area involved. Some people have hyperpigmentation, thickening, lichenification, or cracking of the skin, and dryness is a prominent feature. Usually, a patient’s history and physical examination suffice to diagnose ICD; however, some clinicians request skin prick tests, patch testing, or blood tests. These tests support irritant contact dermatitis diagnoses because they will be negative/normal.

**Allergic contact dermatitis** (ACD) occurs in genetically susceptible individuals who are sensitized to an allergen. Because allergens either come in direct contact with skin or are airborne, ACD usually affects only the exposed area of the body, typically the hands and to a lesser extent the face. Individuals with this condition may be diagnosed through patch testing. The worker likely presents with stinging or burning pain. Affected areas look raw and red, with papules (solid, elevated lesions of 0.5–1 cm or less in diameter that vary in color) and vesicles (elevated fluid-filled lesions of under 0.5 cm).

**Occupational contact urticaria** (OCU) accounts for only 1 to 8% of reported cases of occupational skin disease. It can be seen in individuals who develop immunological skin reactions to plant and animal proteins and enzymes. This condition can affect workers in a wide variety of jobs. The worker is likely to develop itching, redness, edema, and wheals (elevated, itchy, fluid-containing lesions that usually disappear within a short period of time).

**Evaluation of Occupational Skin Diseases**

The first step in assessing occupational skin disease is to take a history. When you evaluate an individual with a skin condition, it is important to address occupational and non-occupational exposures: skin eruptions may, of course, have occupational sources but can also be related to systemic conditions such as infections or generalized allergies. A key question is to determine whether the eruption is work related or related to a systemic condition or generalized allergic reaction. Questions that may help in addressing both the diagnosis and causation include:

<table>
<thead>
<tr>
<th>Question</th>
<th>Relevant Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you have preexisting medical conditions?</td>
<td>Some chronic medical conditions and their treatments can lead to skin eruptions (e.g., connective tissue disorders such as systemic lupus erythematosus), skin dryness (e.g., hypothyroidism), or thinning of the skin in certain areas (steroid injections)</td>
</tr>
<tr>
<td>Do you have a history of atopy?</td>
<td>Individuals with atopy may be at increased risk of developing irritant contact dermatitis.</td>
</tr>
<tr>
<td>Do you have other skin conditions?</td>
<td>Document any previous/existing skin conditions such as actinic keratosis, moles, eczema, or history of skin cancer.</td>
</tr>
<tr>
<td>Are you currently taking any medication?</td>
<td>Steroids and other immunosuppressive treatment and other treatments can have specific side effects on the skin.</td>
</tr>
</tbody>
</table>
Inspection, palpation, and characterization of the lesion are essential components of the physical examination of the skin. If appropriate, a full-body skin examination is preferred, with documentation of findings, such as the presence or absence of moles, scars, or other features.

To identify the potential workplace source of a new skin condition, it is critical for clinicians to understand what a patient does for a living. Providers should establish when and where on the body the patient first noticed the skin eruption, what he or she was doing, whether the eruption spread, and how it looks and feels. ICD is usually localized and does not spread beyond the area of exposure; allergic reactions can spread beyond the area of exposure if they involve systemic response. It is helpful to ask patients to maintain a photo diary of lesions to help with further management of the case.

**Prevention of Occupational Skin Diseases**

Measures to prevent occupational contact dermatitis include elimination or replacement of the agent. Sometimes, engineering measures, such as automation of processes, are needed to remove the irritant. In the case of wet work, employers can reduce employees’ exposure by rotating tasks among all employees; providing personal protective equipment including barrier creams, gloves, after-work skin care and hydration products, and pH-balanced soaps; and administering preplacement screening for preexisting dermatitis. One of the most effective preventive methods is to train workers who use gloves or are involved in wet work about skin care, warning them of signs of skin problems, and ensuring the proper glove size.

**Clinical Pearls**

- Mechanical friction and dryness related to excessive washing and exposure to cold or repeated for repeated or prolonged periods of time can affect the integrity of the skin’s protective mechanisms, leading to increased susceptibility to reactions involving irritant or allergic agents.
- Workers with atopic dermatitis may be at a higher risk of developing irritant contact dermatitis than those without atopy.
- Workers with ACD report severe itchiness and skin changes that include redness, papules, and vesicles. As a result, they often have difficulty returning to their preinjury work even with appropriate personal protective equipment. Many, such as hairdressers, require elimination of exposure to the allergic agent, and some go on to change their craft.
- Chemical and sunburns are types of severe ICD.
- Using diagrams/illustrations to support documentation of the lesion, its distribution, and location can be helpful for follow-up evaluations.
Medical Surveillance – History and Necessity

Marco Britton, MD

The concept of medical surveillance goes back centuries. Pioneers in occupational medicine recognized the relationships between hazards in the workplace and illnesses and injuries that can result from such exposures. Bernardino Ramazzini, considered the father of occupational medicine, published a book in 1700 that outlined several occupational hazards. He recommended that physicians ask their patients about their employment and focused on prevention of diseases and illnesses in the occupational setting. Percival Potts (who discovered scrotal cancer in young chimney sweep workers), Alice Hamilton (considered the mother of occupational medicine and author of Exploring the Dangerous Trades), and others set the foundation for modern medical surveillance programs. In 1970, the Occupational Safety and Health Act was implemented in response to the considerable number of workplace injuries that were occurring. As a result of this act, several medical surveillance programs were created.

Medical surveillance brings to light hazards and exposures, enables providers to identify their health effects (including injuries, illnesses, and mortality), and creates an opportunity for both the health care system and employers to intervene before they worsen. Surveillance is typically either population- or case-based. Population-based surveillance focuses on groups of people and may be used to monitor trends over time, in a particular location, or based on characteristics of the population. Case-based, or individualized, medical surveillance focuses on individual workers.

The Occupational Safety & Health Administration (OSHA) requires surveillance for workers exposed to arsenic, asbestos, benzene, blood-borne pathogens, cadmium, cotton dust, ethylene oxide, formaldehyde, lead, methylene chloride, silica, and more. It also mandates that workers be monitored for occupational noise exposure. OSHA has developed regulations for screening and surveillance for these hazards and is the leading authority for most occupational exposures. OSHA’s publication Medical Screening and Surveillance Requirements in OSHA Standards: A Guide provides a general overview of requirements for some of the hazards listed above. Other requirements can be found on OSHA’s website.

An example of a hazardous substance that requires medical surveillance is crystalline silica—a mineral contained in sand, stone, concrete, and mortar. Silica is also used in various industries for the creation of glass, pottery ceramics, bricks, and artificial stone. Among the most common industrial activities causing exposure to silica are foundry work and hydraulic fracturing, more commonly known as fracking. When workers inhale these airborne particles, they are put at risk for a number of medical conditions, most of which are incurable, such as silicosis, lung cancer, chronic obstructive pulmonary disease, and kidney disease. OSHA has therefore issued silica standards (one for construction and one for general industry and maritime work), which call for medical monitoring of workers.

There are situations where other organizations publish surveillance standards for substances that are not specifically addressed by OSHA. Medical providers should refer patients to their employers to clarify which agency’s standards and requirements they follow. When there is no standard outlined for a particular exposure, employers are guided by the OSHA General Duty Clause, which requires employers to provide employees with a work environment that is “free from recognized
hazards that are causing or are likely to cause death or serious harm.”

For more information, please see the following resources.

https://www.osha.gov/SLTC/medicalsurveillance/surveillance.html
https://www.osha.gov/Publications/osha3162.pdf
https://www.osha.gov/dsg/topics/silicacrystalline/index.html
https://www.osha.gov/silica/AppendixBtosect1926.1153.pdf
Medical surveillance is the systematic, ongoing assessment of employees who are or may be exposed to hazards in the workplace. Unlike screening for health outcomes in the general population, medical surveillance is directed toward at-risk workers with known or potential hazards that lead to specific health effects.

The primary goal of medical surveillance is prevention. It is accomplished through interviews, physical examinations and testing to detect whether workplace controls are effectively reducing exposures. A fully effective occupational safety and health program should not result in any positive findings on medical surveillance examinations. Any time a worker is identified as having signs or symptoms consistent with occupational disease, this finding may reflect a gap in protections. Each positive finding should trigger the occupational health and safety team to evaluate the workplace for such gaps. The identification of adverse health effects at an early stage is not only beneficial for identifying gaps in workplace controls, but also highly beneficial for workers. Early identification allows for appropriate intervention, treatment, and referral, and can help halt the progression of disease.

Mandatory and Voluntary Programs

Medical surveillance programs can be mandatory or voluntary. Mandated programs include those codified in the Code of Federal Regulations. The Occupational Safety and Health Administration (OSHA) has mandated surveillance procedures for more than 20 hazards, including asbestos, blood-borne pathogens, lead, and noise. Employers must pay for mandated surveillance programs and conduct them during compensated work hours. Their components vary, but OSHA-mandated surveillance programs rely primarily on symptom interviews and physical examinations. Ancillary tests, such as pulmonary function testing and chest X-rays, may be used. Providers should be familiar with the health effects associated with the hazard under surveillance; otherwise, they may miss key findings and lose an opportunity to intervene for the collective workforce.

Voluntary medical surveillance programs are those without specific governing regulations and may be performed for a number of reasons. OSHA requires that employers provide a workplace free of recognized hazards, so voluntary medical surveillance programs can be used to provide an extra layer of protection for workers or address chemicals that are not otherwise regulated.

Environmental Monitoring

Medical surveillance programs should not stand alone. They are merely parts of a comprehensive occupational safety and health program. Environmental monitoring, particularly air monitoring, is an essential component in determining the likelihood of toxic exposure for the worker. Industrial hygienists should perform hazard assessments at the workplace and determine whether the hazards are significant enough for employees to be enrolled into a medical surveillance program. Workers with frequent, long, or high concentration exposures are at most risk of developing occupational disease. Environmental monitoring data from industrial hygiene surveys can be tremendously beneficial, helping the provider better understand the scope of work and magnitude of exposures encountered in the workplace. However, these surveys are often difficult for medical providers to interpret, and he or she may need to request assistance from industrial hygienists.
Medical Surveillance Components

Medical surveillance examinations may be administered at an industry site, by a physician contracting with an employer, or by an outside medical facility. The components of the medical surveillance program need to be clearly identified before testing begins, and the program managers must take into consideration frequency and types of testing to be performed, referral processes for those identified with medical conditions, occupational disease reporting procedures, and the planned employer response to sentinel health events. The provider responsible for conducting medical surveillance examinations should have a full understanding of the work performed at the facility, the hazards associated with the work, and the health effects associated with these hazards.

Ideally, medical surveillance examinations should be initiated immediately prior to an employee working in a position with potentially hazardous exposure. This allows for a baseline for comparison to future examinations and test results and provides information about an individual’s suitability for performing hazardous tasks. Periodic examinations are used to detect whether employees have health concerns about the work, physiologic changes from exposure, or occupational disease. The frequency of examinations depends on the potential hazard, the nature of the work, or the age of the employee.

At the time of medical surveillance examinations—which often take place over two visits—the provider should have all available test results before making a determination. The initial visit should focus on collecting laboratory work, imaging, and ancillary testing such as electrocardiogram or audiogram. Biological (toxicological) monitoring may be performed during the initial visit (see Chapter 3, Toxicological Monitoring). The follow-up visit is typically reserved for the worker interview and physical examination, and interpretation of the results from both visits. Upon completion of the second visit, the provider should be able to determine whether the worker has evidence of exposure or an occupational disease. If he or she does, or if biological monitoring levels exceed specific limits, the employee’s work practices, procedures, and conditions should be evaluated by the occupational safety and health team. Additional testing, or retesting, may be needed, and if results remain elevated, removal of the employee from the hazard should be considered. Workforce health trends should be monitored over time to determine whether increased signs or symptoms arise in the course of medical surveillance examinations and ancillary testing.

It is important to note that occupational health records must meet the criteria for confidentiality and regulatory compliance of both OSHA and the Health Insurance Portability and Accountability Act (HIPAA). A medical surveillance program may include specific guidelines for long-term recordkeeping. The employer and employee should be informed of the determination made during the medical surveillance examination by the occupational provider, and all abnormal test results provided to the employee.
Respiratory Protection
Marcia Isakari, MD, MPH, MRO

A respiratory protection program is required in many types of industries, including chemical, health care, construction, and manufacturing. Its main purpose is to prevent workers’ exposure to airborne hazardous contaminants (such as infectious agents, fumes, gases, and particles) that may lead to occupational illnesses, including asthma, pneumonitis, silicosis, tuberculosis, and lung cancer.

The federal Occupational Safety and Health Administration (OSHA) and OSHA-approved state plans require employers to provide a workplace free of recognized hazards. Most state plans have adopted federal OSHA regulations and standards, but some states, including California, Michigan, Oregon, and Washington, have standards that are even more stringent.

OSHA Respiratory Regulations

**OSHA 1910.134** subpart I Personal Protective Equipment (PPE) requires employers to mandate the use of respirators to protect workers from airborne hazards. Employers that fail to comply with minimum OSHA standards are subject to state or federal OSHA citations. Employers are required to have written respiratory protection programs that include:

- designating a program administrator (typically the safety officer)
- performing worksite risk assessments to determine the correct selection of respirators
- providing training on the use and storage of PPE
- providing National Institute for Occupational Safety and Health (NIOSH)—certified respirators when their use is mandatory
- providing information to the physician or other licensed health care professional (PLHCP) about the type of respirator, duration of use, physical effort needed, temperature, and any additional PPE requirements
- providing medical evaluations free of charge—during work hours and at convenient times, by a PLHCP—to workers before they begin using a respirator, and giving employees an opportunity to discuss the questionnaire and examination results with the PLHCP
- arranging for additional medical evaluation if a worker develops symptoms with respirator use or if there is a change in workplace conditions or employee health.

Management and Follow Up

**Medical Examination**
Before mandating respirator use at work, employers must provide medical evaluations to their workers to determine whether they can safely tolerate the physical burdens associated with using respirators. Those burdens include cardiovascular stress, increased body temperature, discomfort, and altered visibility and mobility. OSHA requires that the evaluation:

1) Be performed by a physician or other PLHCP knowledgeable of the physiological demands of a respirator use. Nurses may provide the evaluation in accordance with nursing board standards.
2) Include at a minimum the OSHA medical questionnaire (Appendix C of the OSHA standard) or another medical examination with the same information or as permitted by the state. One example is the California aerosol transmissible disease questionnaire used for health care workers. Further medical evaluation is required if a worker answers “yes” to any question from 1 through 8 on Appendix C, Part A Section 2.

3) Leads to the PLHCP providing the employer a medical clearance letter—free of any medical information—stating only whether the worker is:

- medically cleared to use a respirator—and the appropriate type
- cleared to use only certain types of respirators
- cleared with restrictions (for example, the sole use of a powered air-purifying respirator for a worker who is unable to tolerate a negative-pressure or tight-fit respirator)
- deferred pending further evaluation.

The PLHCP should also indicate when the next medical evaluation should take place.

During the medical evaluation, the evaluator should take into consideration any medical conditions that would affect the worker’s ability to wear a respirator, including diabetes, hypertension, facial features, cardiopulmonary diseases (CAD, COPE, asthma, or emphysema), skin conditions, claustrophobia, age, or heat intolerance.

Self-contained breathing apparatus (SCBA) respirators are used under extreme work conditions (rescue, lethal hazardous air levels) and carry a high physical burden. Although not OSHA mandated, employers should conduct physical examinations and spirometry testing as part of SCBA medical evaluations.

**Periodic Medical Evaluation**

OSHA does not require routine annual medical examinations unless specific trigger events occur, such as:

- The employee reports signs or symptoms related to the ability to wear a respirator.
- The health care provider or employer determines an examination is necessary for any reason.
- A change in the workplace substantially increases the physiological burden on the employee.
- There is a change in the worker’s ability to use respirators.

Health care providers typically recommend a time frame for follow-up. Research by the American College of Occupational and Environmental Medicine, American National Standards Institute, and NIOSH supports periodic health evaluations based on employee age and respirator type. The Navy’s protocol (abbreviated as OPNAV) includes a periodic respirator medical evaluation every five years for those under 35, every two years for those ages 35 to 44, and annually for those 45 and over or using the SCBA. Employers often opt to conduct periodic medical evaluations to avoid citations that may occur if a trigger event is missed. Employers in the petrochemical industry routinely choose to reevaluate employees on an annual basis.
Implementation of Processes and Procedures

Respirators either filter or supply alternative air sources, thus reducing or eliminating exposure to airborne hazards. The two main types of respirators are:

- air purifying, removing air contaminants. Examples include the N95 and half and full-face respirators.
- air supplying, such as the SCBA, providing alternate sources of clean air.

Respirators must be NIOSH certified and have an assigned protection factor (APF)—that is, the level of respiratory protection expected under ideal conditions. For example, an N95 respirator rated APF=10 will reduce the concentration of the contaminant to one-tenth. Employers must select respirators based on the specific airborne hazards related to the duties at hand. Many hazards are OSHA regulated according to the permissible exposure limit.

Surgical masks are not respirators but fluid barriers and thus do not provide the same protection as the N95 respirator, which provides protection against aerosol-transmissible diseases like tuberculosis and influenza.

Respirator Fit Testing

OSHA mandates fit testing, after the worker is medically cleared by a PLHCP, to confirm an adequate seal for all tight-fitting respirators (such as the N95, half face, or full face) before the start of use and on an annual basis. The worker must be allowed to choose the respirator from a sufficient number of models and sizes. The fit tester does not need to be licensed or certified but should be trained to follow OSHA 1910.134, Appendix A.

There are two types of fit testing:

- Qualitative: This pass/fail test, the most commonly performed for which there is a readily available testing kit, is used for negative-pressure and air-purifying respirators. The challenge agent usually is either saccharine or Bitrex™.
- Quantitative: This test can be used for any type of tight-fitting respirator but is required for those with APF of 50 or above and SCBA (according to the National Fire Protection Association).

Common respirator types, APF, uses, and fit testing requirements:
<table>
<thead>
<tr>
<th>Respirator Type</th>
<th>APF</th>
<th>Use</th>
<th>Need for fit testing</th>
<th>Type of fit testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filter face piece: N95</td>
<td>10</td>
<td>Respiratory infection control of aerosol-transmissible diseases</td>
<td>Yes</td>
<td>Qual or quant</td>
</tr>
<tr>
<td>Half face</td>
<td>10</td>
<td>For grinding, handling certain chemicals, welding.</td>
<td>Yes</td>
<td>Qual or quant</td>
</tr>
<tr>
<td>Full face</td>
<td>50</td>
<td>Similar to half face but five times the protection; protects eyes and covers most of the face</td>
<td>Yes</td>
<td>Quant if APF &gt; 50</td>
</tr>
<tr>
<td>Powered air purifying</td>
<td>25</td>
<td>For health care settings (high-exposure aerosol-transmissible diseases, or when facial hair or deformities preclude use of N95)</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>Air supplied, self-contained breathing apparatus</td>
<td>1000</td>
<td>Firefighters, rescue, or &quot;immediate danger to life or health&quot; conditions</td>
<td>Yes</td>
<td>Quant</td>
</tr>
</tbody>
</table>

**Resources**

**Online**

OSHA Hospital Respiratory Protection Program Toolkit

Joint Commission Implementing Hospital Respiratory Protection Programs: Strategies from the Field

U.S. Navy Medical Respirator Medical Evaluation Printed Guides


Biological monitoring in the occupational setting is used to determine levels of exposure and/or health effects for workplace hazards. Most commonly, biological monitoring is performed during routine medical surveillance examinations. However, it may also be used in response to a specific event resulting in high exposures to a known hazard. Its primary goal is to identify substances or metabolites in the body or subclinical health effects before they cause negative health outcomes.

Biological monitoring involves both direct testing of substance levels in the body and indirect testing to determine the magnitude of an exposure’s effect, without directly measuring the substance or metabolite itself. An example of direct testing is checking for cadmium exposure through blood cadmium levels. An example of indirect testing is the beta-2 microglobulin urine test for cadmium, which tests for kidney damage as a result of chronic cadmium exposure.

Biological monitoring can be a required component, or a useful adjunct, to a medical surveillance program. To monitor workers’ exposure, medical surveillance programs generally rely on biomarkers of both exposure and effect. Biomarkers of exposure provide a measure of body burden for a chemical, whereas biomarkers of effect measure the physiologic responses in the body from a hazard. Biological tests not only help physicians confirm exposures or diagnoses but also assist industrial hygienists in determining which workers are at risk and the effectiveness of workplace controls.

Biological monitoring can be performed for the full spectrum of occupational hazards, from physical hazards such as noise to more common chemical hazards such as lead. OSHA requires biomonitoring with mandated surveillance for three chemicals: benzene, cadmium, and lead. These chemicals span a wide range of industries, from the oil and gas industry to military defense to construction. OSHA mandates that biological monitoring for these chemicals occur once the hazard has been identified in air concentrations in excess of occupational exposure limits. For example, if an industrial hygienist performing a hazard assessment determines that an employee is exposed to air concentrations of cadmium at or above the action level (2.5 µg/m³ over an 8-hour time-weighted average) for 30 days or more in a 12-month period, the employer is obligated to enroll the employee (and employees in a similar exposure group) into a medical surveillance program. This program includes biomonitoring, relying on urine cadmium, blood cadmium, and urinary beta-2 microglobulin to assist in determining whether workers are experiencing both hazardous exposure to and effects from cadmium. For lead, OSHA mandates that employees receive blood lead testing once air levels exceed the action level (30 µg/m³ over an 8-hour time-weighted average) in the workplace. However, recent evidence has shown that blood lead levels may reach harmful levels at air concentrations below occupational exposure limits. Thus, using blood, rather than air, lead levels to drive workplace controls can help prevent overexposures and subsequent health effects.

In addition to those chemicals regulated by OSHA-mandated medical surveillance programs, many others are associated with biomarkers that help the provider determine whether hazardous exposures or effects have occurred. The American Conference of Governmental Industrial Hygienists (ACGIH) publishes biological exposure indices (BEIs)—guidelines to assist in controlling workplace hazards that list concentrations in the body for substances and metabolites that correlate with air levels of the substance. If chemical concentration levels exceed a BEI, they may indicate workers’ overexposure to a toxic chemical. With sustained overexposure, adverse health effects may develop. BEIs should always be
interpreted and applied by an individual trained in industrial hygiene and/or occupational medicine. The BEI Guidelines are available for purchase.

**Establishing a Biological Monitoring Program**

Specific criteria must be met before an employer initiates a biological monitoring program. First, the chemical must be present in a medium suitable for sampling, such as blood, urine, or exhaled air. The collection method should be discussed and found acceptable to those individuals who are being tested. For example, if a workforce generally refuses blood testing because it is seen as invasive, urine testing may be considered a more acceptable alternative. Analyzing samples should be practical and produce valid, reproducible results. Furthermore, samples should be collected in a manner in which they are relevant to the work being done and can be interpreted meaningfully. Perhaps most important, the program should specify from the start an action plan to respond to aberrant results. If all of these criteria are met, and the sampling will do the workforce more good than harm, then a biological monitoring program can be established.

Proper timing of sample collection is important: those samples with short half-lives may be sampled during or at the end of work shift; whereas, samples with half-lives of years do not require immediate collection. Sample timing, collection methods, and media collected are all essential factors to consider when collecting samples.

**Routes of Exposure**

Environmental monitoring assesses chemical levels in the air in the workplace. Controls, such as respirators, can prevent airborne chemicals from entering a worker’s body. High air-chemical levels detected through personal-breathing-zone monitoring indicate overexposure, but adequate personal protective equipment is intended to interrupt the exposure pathway and prevent the worker from experiencing harmful health effects. If respirators appear adequate, yet workers continue to show elevated toxin levels on biological monitoring, other exposure routes must be considered. This issue is particularly important for chemicals that are readily absorbed through the skin. Additionally, chemicals that can contaminate the workplace, such as lead, may be ingested, resulting in a high body burden even when airborne levels appear negligible.

Reviewing providers must have a full understanding of the reasons for testing and the health effects of a chemical. All abnormal results on biological monitoring should lead to a thorough review of the worker’s health and the worker’s practices, procedures, and working conditions. However, actions taken as a result of biological monitoring should rely on multiple measurements rather than a single test. Workers should be counseled to share these results with their personal physicians, to ensure that primary care providers are aware of any findings discovered.

Biological monitoring must be performed at the expense of the employer, not the employee. The results should not affect the relationship between the employee and the employer, nor should it affect the employee’s pay. If an employee has elevated levels on biological testing and must be removed from the work environment, he or she must retain his or her pay and should not be penalized in any way. The length of medical removal depends on such factors as the time it takes to eliminate a chemical, the health effects experienced by the employee, or OSHA-mandated medical removal periods.
Hearing Conservation

Marco Britton, MD

Noise-induced hearing loss (NIHL) is one of the most common occupational disorders in the United States. The Centers for Disease Control and Prevention estimates that 22 million workers are exposed to unsafe noise levels yearly, and 19% of these workers are hearing impaired. Hearing loss often occurs over a period of time as a result of repeat exposure to high noise levels and is permanent. However, brief exposures to loud noises tend to cause temporary loss that returns to baseline after a period of rest. NIHL is preventable. As such, the Occupational Safety and Health Administration (OSHA) has created the Occupational Noise Exposure standard that guides industries in hearing-conservation efforts.

Hearing loss also can be produced by chemicals, drugs, and metals (“ototoxins”) with which people come in contact in the workplace. In many cases, the mechanism of injury is not fully understood by the medical community, and more research needs to be performed. The American Conference of Governmental Industrial Hygienists recommends periodic testing for employees exposed to ototoxins, but currently there is no standard that addresses ototoxic chemicals in the workplace.

In addition to identifying work-related causes of hearing loss, medical providers should also consider non-occupational exposures, which can both cause and exacerbate hearing loss.

Noise-Induced Hearing Loss

Continuous exposure to loud sounds results in NIHL. OSHA considers noise levels at or above 85 dB to be hazardous to hearing and damage structures within the inner ear over time. Due to the gradual nature of NIHL hearing loss, employees may not notice it until several years after the exposure. Thus, proper hearing protection and frequent monitoring is necessary.

Brief exposures to intense sound blasts can also lead to NIHL, which may be either temporary or permanent. In the workplace, explosions, which release over-pressurized waves, are a common cause of sound blasts. The impact of the waves ruptures the tympanic membrane, disrupts ossicles, and damages the cochlea. The extent of damage generally depends on the intensity of the sound and the resultant wave produced.

Ototoxic Chemicals

In the United States, an estimated 10 million workers in diverse industries, from pharmaceuticals to construction, are exposed to ototoxins that can damage inner-ear structures. Therapeutic agents such as aspirin, diuretics, antibiotics, and chemotherapeutic medications, in addition to heavy metals and various other chemicals, are among them. It is not fully known how these substances cause inner-ear damage, but researchers have proposed possible explanations. For one, antibiotics such as aminoglycosides that are able to cross the blood-labyrinth barrier are thought to induce hair cell death by disrupting intracellular processes. In addition to hair cell damage, these agents also damage the central nervous system, including portions involved in hearing.

Non-Occupational Exposures
Non-occupational exposures must also be considered as possible causative and contributory factors to hearing loss. Recreational activities such as hunting and target shooting, listening to loud music, and participating in motorsports can also contribute to hearing loss. Medical providers should be aware of their patients’ participation in such activities and take time to counsel patients on wearing hearing protection every time they are engaged in them. When evaluating patients, clinicians should also consider medical conditions that affect hearing, such as infectious diseases, genetic disorders, neurologic disorders, strokes, head injuries, and auditory and central nervous system neoplasm.

**Occupational Noise Exposure Standard:**

OSHA addresses hearing conservation in the Occupational Noise Exposure standard (1910.95), which guides employers and providers in assessing noise exposure in the workplace. The standard requires industries to reduce noise levels for workers who are exposed to 85 dB or greater during an eight-hour period. It also outlines various other PELs based on the number of hours the employee is exposed to noise per day.

Employees who are constantly exposed to 85 dB of sound over an eight-hour working period (called an eight-hour time-weighted average) must be monitored annually, and employers must provide audiometric testing free of charge. Testing starts with a baseline audiogram, which usually takes place during the preplacement examination, but employers are given up to six months from the employee’s first exposure to an eight-hour time-weighted average of 85dB to provide it.

Annual audiograms allow hearing decline to be identified and guides employers to supply employees with proper protection. Each audiogram is compared to baseline to detect whether there has been a standard threshold shift (STS)—an average change in either ear of 10 dB or greater at 2,000, 3,000, and 4,000 hertz.2, 6 If an STS is indicated, then the employer must retrain the worker to use the hearing protection equipment and require the employee to wear it. The employer has 21 days to notify the employee of the STS.

In addition to annual audiograms, repeat testing is required when workplace noise exposure levels change, to ensure that adequate hearing protection is provided.

**Failure to Comply**

Industries that fail to comply with the Occupational Noise Exposure standard risk accruing fines. Employees who fail to comply with company rules pertaining to hearing conservation are at risk for various repercussions, including disciplinary action and termination. Each company has its own policies thus employees should be encouraged to familiarize themselves with them.

Primary care providers play a vital role in employee hearing conservation efforts. At each clinic visit, a brief hearing history should address the duration and types of noises patients are exposed to. Providers should also assess whether protective hearing equipment is required on the job and whether the employee is compliant. Recreational activities, such as hunting, target shooting, and motor sports, should also be explored. Providers can use clinic visits as opportunities for educating patients on the importance of avoiding loud noises when possible and wearing hearing protection when needed.
References:


CHAPTER FOUR
FITNESS FOR DUTY
Introduction: What Is Fitness for Duty?
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Being fit for duty means that an employee’s physical, emotional, and mental condition allow him or her to perform essential job duties in a proper, safe, and competent manner. An unfit employee is one who cannot perform those duties according to these standards, regardless of the reason. Employees are expected to report to work fit for duty and remain fit while on duty. It is the responsibility of supervisors to monitor employee performance and behavior, to require fitness for duty, and to have policies in place to ensure worker fitness.

Fitness for Duty (FFD) evaluation is a medical evaluation performed by a licensed medical practitioner at the request of an employer. These evaluations are conducted to determine work-duty assignments among a variety of employment settings. Certain employees, such as law-enforcement officers and firefighters, undergo evaluations at regular intervals (such as annually) due to the rigorous physical requirements and medical standards required by their work. Medical guidelines are produced by regulatory agencies to help providers make decisions regarding these groups. However, even an employee in a sedentary job may require an FFD due to cognitive or behavioral issues or physical conditions such as carpal tunnel syndrome.

FFD exams are also required by statutory mandate in certain industries. For example, the Federal Motor Carrier Safety Administration, Federal Aviation Administration, and Occupational Safety and Health Administration (OSHA) require certain workers (truck drivers, pilots, and asbestos workers, for example) to undergo medical exams on a periodic basis.

Various types of FFD tests are conducted to determine whether an individual is fit for work at the time of hire or upon return to work following injury, illness, or prolonged absence, or when there is concern about whether a worker can safely perform the job (“for cause”). These tests may also be performed periodically for high-risk and safety-sensitive professions (for example, firefighters, law-enforcement officers, and emergency medical technicians).

A variety of laws and regulations govern the timing and scope of FFD requests, including those outlined by the Americans with Disabilities Act (ADA), Equal Employment Opportunity Commission (EEOC), Genetic Information Nondiscrimination Act (GINA), and Health Insurance Portability and Accountability Act (HIPAA).

An FFD examination administered by a healthcare provider may be given only after a job offer has been made. It is strictly prohibited to ask a prospective employee in the pre-offer stage to submit to a FFD examination. However, an employer can make pre-employment inquiries into the prospective employee’s ability to perform job-related functions or perform an agility test without medical examination or monitoring. An employer is allowed to make a job offer conditioned upon the successful completion of a medical exam if two conditions are met:
The examination is applied uniformly to all entering employees in the same job category. The employer legally must base its decision only on information directly related to job fitness. (For this reason, employers are advised not to acquire any additional medical information from the FFD evaluator, and if they do, not to place it in an employee’s file.)

Further, an employer can request an FFD exam when:

- An individual has applied for or occupies a position with physical requirements or medical standards
- An employee has applied for or is receiving continuation of pay or compensation as a result of on-the-job injury or disease
- An employee is given a transfer or promotion, and the position to which the employee has reassignment rights has medical standards or specific physical requirements that are different from those of the employee’s previous position.

**Reasons for an FFD Referral**

The reasons that an employee might be, or become, unfit are many. They include, for example, physical problems, mental illness, drugs or alcohol use, prescription medication use, stress or other emotional problems, work-related injuries, and non-work-related accidents or other issues. Generally, when a manager or supervisor observes a change in an employee’s behavior or capacities that presents a direct threat of harm to self or others, the manager, in consultation with human resources staff, can investigate to see whether there is a reasonable explanation for this change and whether a “for cause” FFD evaluation is warranted.

An employer may require an employee to undergo an FFD examination for a number of reasons. In some cases, an employee has exhibited a sustained pattern of poor performance of duties. In other cases, the employee may have exhibited a gradual or sudden deterioration of performance, which may or may not have been documented in the personnel file. An FFD exam may be triggered when an employee poses an imminent and serious safety threat to him- or herself or others or is generally having difficulty performing work duties in a manner that is safe for the employee, clients, public, or coworkers. An FFD exam also might be triggered by unclear written correspondence, inaccuracies in work, or the need for unusually close supervision. Documented factors such as low mood and poor attitude in response to criticism that interfere with work may also indicate a need for such an exam.

The question of whether to perform the evaluation is always based on whether the employee is capable of performing the necessary job duties and doing so safely. In addition to providing the FFD evaluator the reason for the referral, the employer also must provide the job description and accurate portrayal of job duties.

**Potential Outcomes**

Fitness for duty evaluations can result in a variety of outcomes, ranging from a safe return to work, either with or without accommodations, immediate termination, referral to a specialist for further evaluation, or referral to an employee assistance program. Sometimes the FFD evaluation is unrevealing or even turns out to have been inappropriately referred.
The Evaluation Process

The mechanisms that FFD evaluators use to evaluate fitness for duty include a verbal interview, observation, and physical examination. In some cases, job-simulated functional tests are also used to determine fitness for duty. When performing an FFD evaluation, in addition to considering legal regulations, addressed later in this chapter, the evaluator must consider workplace policies (such as whether an employee works in an established Drug-Free Workplace), individual job duties, and safety or competency criteria for the individual’s job.

Interview
An FFD interview should be conducted in a private location by a qualified evaluator. It is preferable to have another appropriate member of the care team present.

The evaluator must take a full medical history, including an assessment of activities of daily living and instrumental activities of daily living; a social history; and occupational history. With the advent of GINA, family medical history information generally should not be obtained during a medical examination. However, there are exceptions when information derived from a family medical history is [See below, Genetic Information Nondiscrimination Act (GINA) of 2008.]

Observation
An FFD evaluator may make observations regarding the examinee’s gait and posture walking and standing, speech, eyes, face, appearance, breath odor, eating and chewing, demeanor, actions, and cognitive abilities.

Physical Exam
In general, FFD test protocols include a medical/physical examination. A basic physical examination may include vital signs, coordination testing, and a mental status examination. Advanced evaluations may include psychometric testing or neurocognitive testing.

Functional Testing
Job-simulated functional capacity evaluations may include stair or ladder climbing and postural, lift, carry, push, and pull tests that represent physical work demands specific to the individual’s job.

Very often, evaluations are not completed in one sitting, and additional evaluation and referrals may be necessary. The evaluator may call for special medical tests (such as radiographs, MRIs, pulmonary function studies, and so on) that are deemed appropriate for the job in question. In some cases, consultation with additional specialists and/or the employee’s personal physician may be appropriate. Sometimes, a safety assessment by an industrial hygiene officer or safety officer within the employer’s company is requested.

Often, health conditions, such as cardiac issues, arise during the FFD evaluation. The evaluator may at times send a patient to his or his health care provider to contribute to the evaluation. In these cases, the FFD evaluator serves as a mediator between the patient’s doctor and the employer’s human resources department, ensuring confidentiality of all medical information. Adverse actions (such as the withdrawal of a job offer) can be taken only against an examinee based on tests that are job-related.
Neuropsychological Testing
Neuropsychological testing may be required when an employee has a pattern of compromised performance that is not attributable to issues such as lack of training or poor supervision. It can also be used to set a baseline of cognitive performance when an employee is being monitored for progression of disease or disability or to help differentiate between compromised cognition and stress-related cognitive complaints.

Neuropsychological tests compare individuals’ cognitive abilities to a normative standard, and their results can indicate impaired behavior that might compromise safety on the job. Employers must be careful not to use this type of testing to address behavioral or interpersonal issues that are best addressed by administrative or human resources interventions or through training.

A decrease in neuropsychological capacities may compromise safety-sensitive tasks. Therefore, neuropsychological tests must be performed when tasks require vigilance and working memory, when the examinee is driving or operating vehicles, and when fine-motor coordination and steadiness are required to perform sensitive operations (for example operating machinery, discharging a weapon, or performing surgery).

A growing issue in FFD examinations is workplace violence. Committing a verbal or physical assault constitutes a clear medical and/or psychiatric emergency, and in that case a worker may be referred for a psychiatric FFD evaluation. The evaluator’s first interest is always that of the patient and how the patient’s safety and immediate needs, as well as safety of coworkers, will be best met when considering whether to send him or her back to work. Primum non nocere; that is, first do no harm. In an event where behavior does not require immediate intervention, a medical evaluation may be appropriate. The evaluator makes such determinations.

In all FFD evaluations, documentation is extremely important and should include specific observations as much as possible. The evaluator should remain objective and nonjudgmental, assessing in an unbiased way an employee’s physical characteristics, intellectual ability to perform, and interpersonal behavior and judgment.
Legal Aspects of Fitness for Duty Tests

Richard W. Bunch, PhD, PT, CBES

Fitness for duty (FFD) examinations can seem confusing and intimidating to both health care professionals and employers, due to the myriad regulations that affect employment screening. Moreover, the methodologies used in FFD examinations vary. Some examinations are customized for specific jobs; some are generic; and some are dictated by federal agencies (for example the U.S. Department of Transportation or U.S. Coast Guard). Regardless of the protocol, FFD examinations must be carefully designed and administered to comply with federal regulations established to help ensure equal job opportunities for protected classes related to disability, obesity, gender (including gender identity and sexual orientation), pregnancy, national origin, age, genetics, race, color, religion, and sex.

If a post-offer, preplacement FFD examination is not administered correctly, the employer may find itself facing a charge of discrimination by the U.S. Equal Employment Opportunity Commission (EEOC). FFD evaluators therefore have both professional and fiduciary responsibilities to employers for conducting examinations in a manner that is compliant with employment discrimination laws.

The American with Disabilities Act

The Americans with Disabilities Act (ADA-1990) and the ADA Amendments Act (ADAAA-2008), collectively referred to here as ADA, are the most notable of the federal regulations designed to prevent employment discrimination. Title I of the ADA makes it unlawful for an employer to discriminate against a qualified person with a disability. The ADA defines disability as a physical or mental impairment that substantially limits one or more major life activities; a record (or past history) of such an impairment; or the state of being regarded as having a disability. To prove discrimination under the ADA, a person must show that he or she has been subjected to an action prohibited under the law—regardless of whether the impairment limits or is perceived to limit a major life activity. The conditions for what constitutes a disability were expanded on by the ADAAA. These include impairments that are episodic or in remission but would substantially limit major life activities when active. Impairments that substantially limit major life activities are considered disabilities regardless of whether individuals are able to take measures to mitigate the problems, such as by taking medications or wearing prostheses.

Medical Inquiries and ADA

A medical examination cannot legally be performed prior to a job offer. Nor can information be provided to an employer about disability, medical history, medications, or prior workers’ compensation claims before an offer. However, an employer can ask a job applicant prior to a job offer if he or she is able to perform job-related functions or ask him or her to demonstrate the ability to perform job-related functions (such as lifting a weight or climbing a ladder), as long as there is no medical testing or monitoring (such as a blood-pressure reading).

Qualified Individual with a Disability

A qualified individual with a disability is a person who has the needed skills, experience, education, and other job-related requirements to perform the essential functions of a job—not marginal...
duties—with or without reasonable accommodations. If a qualified individual with a disability fails an FFD examination, employers must conduct an “interactive accommodation review” to determine whether the workplace can offer reasonable accommodations to work. For more guidance on enforcement of ADA regulations, visit eeoc.gov/policy/docs/guidance-inquiries.html.

**Direct Threat – A Key Issue in FFD Determinations of Work Ability**

Although the ADA prohibits discrimination on the basis of disability, an employer may legally decide not to hire a person with a disability if that person poses a direct threat of harm—that is, a significant risk to the health or safety of him- or herself or others that cannot be eliminated by reasonable accommodation.

Determining whether someone poses a direct threat must be based on an individualized assessment, such as an FFD examination, of the individual’s ability to safely perform the essential functions of the job. This assessment must rely on reasonable medical judgment based on the most current medical knowledge and/or on the best available objective evidence. When assessing direct threat, the following factors should be considered:

- Duration of risk
- Nature and severity of the potential harm
- Likelihood that the potential harm will occur
- Imminence of the potential harm.

In essence, direct threat under ADA means the harm must be serious and “likely” (or reasonably determined) to occur, not remote or speculative. Note the term “reasonably determined” is analogous to the ritualistic words “reasonable degree of medical certainty” used by medical expert witnesses in most state and federal courts to imply that there is at least a 51% probability.

**Role of the FFD Evaluator**

The role of the evaluator when assessing fitness for duty is to identify any conditions or diagnoses that, in the context of the job, could result in a significant risk or harm to self or others, including the public. In addition, the evaluator’s role is to provide an unbiased opinion. Before conducting the assessment, the evaluator should have the following information:

- Knowledge of any established or verified diagnoses potentially affecting the individual’s ability to function on the job
- The essential physical requirements of the job
- Knowledge of any possible regulatory requirements for the job
- Knowledge of biomechanical factors related to any diagnoses (such as the impact of spinal compression on a person with a diagnosis of a ruptured disc when lifting)
- Recognition of possible psychosocial factors affecting fitness for duty
- Potential workplace accommodations available.
Assessing Risk, Capacity, and Tolerance to Work

Determining whether a person is able to work safely can be difficult and challenging: it has the potential to affect individuals’ livelihoods as well as employers’ human resources by influencing workers’ employability, job transfers, promotions, workers compensation, and disability determinations. Conducting an FFD examination is both a science and an art. According to the AMA Guides to the Evaluation of Work Ability and Return to Work, when assessing ability to work, the evaluator should consider three primary factors: risk, capacity, and tolerance. Assessment of the first two of these factors, risk and capacity, can be correlated to federal guidelines established by the ADA.

Risk
Risk refers to the chance that a worker will cause harm to self or others when performing work. The FFD evaluator primarily determines risks related to known medical conditions. No one can expect an FFD evaluator to know with 100% certainty that an employee can work without risk of being injured or injuring someone else. However, the expectation is that the FFD evaluator will make decisions based on a reasonable degree of medical certainty. When it comes to assessing risk, the ADA provides the “direct threat” standard as the bar that the evaluator may use.

Capacity
Capacity refers to scientifically measurable physical abilities, such as strength, flexibility, and endurance. A well-designed FFD examination adequately measures these physical parameters. Therefore, combining the evaluator’s medical expertise with the objective measures derived from valid FFD tests, in most cases, provides an effective means to assess work ability within a reasonable degree of medical certainty. Regarding capacity, the ADA provides that the FFD evaluator should compare the employee’s strength, flexibility, and aerobic capacities to the “essential physical demands” of the job.

Tolerance
Tolerance refers to the ability to tolerate performing sustained work or work at a certain level. Tolerance is purely a subjective determination and includes the concepts of pain. Tolerance presents the greatest challenge to the FFD evaluator, especially in return-to-work cases. This factor can be positively or negatively affected by psychosocial or psychological factors, such as motivation to return to work, and therefore defies scientific measurement or verification.

Legal Aspects of Drugs and FFD Testing

In general, prior to a job offer, the ADA allows a job applicant to be asked about any current illegal use of drugs (including prescription drugs without a lawful prescription); such inquiries are not prohibited by federal or state discrimination laws. In some states, a job applicant cannot be asked about the use of marijuana. FFD evaluators should remain vigilant and attentive to laws dealing with questioning job applicants about marijuana and other drugs, which are evolving in various states. Individuals who use legally prescribed opioid medications, as well as recovering and recovered substance abusers, are considered “disabled” by the ADA and comparable state laws. Therefore, prior to a job offer, an individual may not be asked about lawful drug use, because such questions are likely to elicit information about a disability. However, in cases when there is a positive drug test result, the evaluator is allowed to ask about lawful drug use or other possible explanations to validate the result.
Of special concern, from a safety perspective, is conducting FFD tests on test recipients while they are taking prescribed opioids or other legal pain killing medications. Such drugs not only signal the presence of pathology but may mask pain enough to allow further tissue damage to occur during FFD testing without the examinee reporting increased pain. Also, the performance of a test recipient taking pain medication during an FFD test may exceed and falsely represent what can be performed at work.

In view of these effects of pain medications, the FFD evaluator should have policies and procedures in place related to test subjects who report symptoms or take pain medications at the time of the exam. At the time of this writing, there is no clear EEOC guidance on the issue of testing an individual while he or she is taking pain medications; however, some recommendations can be made based on current law.

First, anyone reporting for an FFD test while symptomatic and/or on pain medications (including anti-inflammatory medications) should trigger a thorough medical evaluation to assess the nature of the symptoms and/or the basis for the medication. Whether to render a safety-related FFD test is entirely up to the evaluator. Safety is paramount: honor the “first do no harm” doctrine. If the painful condition is considered transitory, resolving in less than six months, the test recipient is technically not protected by the ADA. In such a case, the FFD evaluator would be justified to refuse to conduct the FFD until the person’s transitory medical condition has resolved and he or she is off pain medication.

In cases in which the FFD evaluator finds that the test recipient’s painful condition is chronic, expected to last longer than six months, the test recipient has ADA protection. The evaluator, in such cases, should complete a detailed medical examination and determine how to proceed based on the severity, irritability, and nature of the condition. These findings should be compared to any exertional demands from functional testing (if used) to determine whether there is significant risk in undergoing the FFD. If the evaluator’s opinion is that the FFD would be too risky to proceed, then the medical information forming the basis for the opinion is documented, and the employer should be notified to conduct an interactive accommodation review.

**Obesity and FFD Examinations**

The increasing obesity rate in the United States has affected work ability in a variety of ways. The question is: when is obesity a disability that must be accommodated under the ADA? Fundamentally, employers and FFD evaluators cannot discriminate against a person based on obesity alone. In the EEOC’s ADA Compliance Manual, the issue of obesity is addressed as follows:

“Their is no clear obesity as an impairment.... On the other hand, severe obesity, which has been defined as body weight more than 100% over the norm, is clearly an impairment. In addition, a person with obesity may have an underlying or resultant physiological disorder, such as hypertension or a thyroid disorder. A physiological disorder is an impairment.”

In addition to not discriminating against someone because of weight alone, employers need to be careful of making any assumptions about obese individuals and their potential for health problems or Workers’ Compensation claims. When compared to employees who maintain the recommended weight, obese employees are known to have higher health care costs, file more Workers’
Compensation claims, and miss more work due to work-related injuries. However, caution must be taken in making any employment decisions based on these trends. Failing to hire someone because of concerns related to weight could indicate that the applicant was perceived or regarded as disabled—a violation of the ADA.

Any request for an accommodation from an obese employee, especially an employee with an underlying or resultant physiological disorder, should be regarded as a request for accommodation from a person with a disability. In such a case, as with all covered disabilities, the employer should conduct an interactive accommodation review to determine whether reasonable accommodations exist.

In summary, the obese person must be given the same opportunity to pass a job-specific FFD examination as any other person. An obese person who fails to meet the essential job demands due to reduced physical capacities (such as reduced strength) unrelated to obesity is technically not considered disabled and thus not protected by ADA. However, job applicants who are severely obese and/or applicants who fail the FFD examination due to an impairment or disability related to the condition of obesity are protected by the ADA.

Disparate Impact of FFD Tests on Females and Older Workers

In general, the FFD testing process must be designed not only to protect against discrimination related to disabilities, but also to avoid discrimination on the basis of sex per Title VII of the Civil Rights Act of 1964 or age (40 and older) per the Age Discrimination in Employment Act of 1967. If FFD testing does result in disparities among employees by sex or age, the FFD examiner must be able to justify and defend his or her conclusions based on the essential job functions provided by the employer. In other words, the employer must show that the FFD tests reflect job demands that must be performed without assistance and that failure to perform such essential job tasks would mean that the job cannot be done or cause a serious interference with job production. In jobs with heavy essential job demands, a disparate impact on weaker individuals (due to gender and/or age) can be expected.

Pregnancy and FFD Testing

The Pregnancy Discrimination Act, an amendment of Title VII of the Civil Rights Act of 1978, provides women with federal employment protection from any form of employment discrimination related to pregnancy. Considering the effects of hormonal changes during pregnancy, the increased risk of miscarriage in the first trimester, changes to a woman’s body particularly during the second and third trimesters, and medical complications of pregnancy such as eclampsia, the risk of injury during an FFD evaluation can be a concern for the FFD evaluator. Research on the safety of lifting while pregnant is relatively scarce, and existing studies do not take into consideration the variables of real-world lifting besides weight, such as the dimensions of the item lifted, the horizontal distance of the lift (reaching), the angle of rotation (twisting) during the lift, and so on.

Liability for injury to the fetus has no statute of limitation. Therefore, at the very minimum, a carefully conducted medical examination should clear a pregnant woman prior to undergoing an FFD test that requires significant physical exertion such as heavy lifting. However, there is another, safer, option that the evaluator and employer should consider. Since there is an inherent increased
medical risk for a pregnant woman at any stage to become injured during physical exertion, one accommodation can involve the FFD evaluator conducting the examination without exertional functional tests. The employer could likewise accommodate the employee at work in the same fashion until after the pregnancy is over. After delivery and recovery from pregnancy, pending medical clearance, the employee should undergo a job-specific FFD test to determine whether she can begin working full duty, or if she will require continued accommodations.

**Legal Aspects of FMLA and FFD Tests**

It is not legal, under the FMLA, to require FFD evaluations as a condition for returning to work, unless there is a reasonable concern that an individual has work limitations after he or she returns from leave.

However, before restoring an employee to work following an FMLA leave, an employer may have a “uniformly applied policy or practice that requires all similarly situated employees (i.e., same occupation, same serious health condition)” to obtain and present a certification from the employee’s health care provider that the employee can resume work and can perform all of the essential functions of the job.

**Genetic Information Nondiscrimination Act (GINA) of 2008**

The protection of family medical information, including that obtained through genetic testing, is a particularly complex issue. EEOC guidance on how a family medical history can be used in FFD examinations is uncertain as of this writing. Obviously, in cases where family history (such as cardiovascular disease) clearly aggravates the risk of unsafe performance of an essential safety-sensitive task, there would seem to be an FFD evaluator obligation to ask all employees about family history of cardiovascular problems in the course of testing.

In general, the FFD evaluator should not obtain family medical history or other genetic information from a job applicant, even after an offer of hire is made, unless there is a defensible reason based on job safety. But since understanding family history is critical in examinations for certain high-risk jobs (for example, firefighters) the evaluator may proceed with acquiring family history as long as the *family history information is not shared with the employer*. It would not be appropriate, however, to inquire about family medical history that does not relate in any way to job safety. The EEOC is currently assessing these types of conflicts with GINA that relate to acquiring family history when that knowledge may prevent a person from facing direct threat of harm on the job. The bottom line is that family medical history information must be kept fully confidential, and not shared with the employer. Consequently, FFD evaluators should check all FFD-related documents provided to employers to ensure that there is no content related to family history or genetic testing.

**HIPAA and FFD Testing**

It is generally accepted that HIPAA regulations do not apply to disclosure of medical information collected by an employer in the course of administering post-offer FFD examinations for hiring. However, despite this general agreement, it is still advisable—and a court decision has supported this advice—for evaluators to follow HIPAA confidentiality guidelines when conducting FFD examinations in order to help protect employers from potential invasion of privacy lawsuits.
Implementation of a Fitness for Duty Testing Process

There is no set methodology to predicting fitness to perform job tasks over time based on a one-time examination. But taking the proper steps to carefully develop and design an FFD testing program is essential to conducting exams fairly to both employee and employer and to avoiding legal challenges. When implementing a legally compliant post-offer FFD program that includes medical monitoring and testing, steps should be taken to ensure that the testing process is:

1. **Legal**: FFD testing must be compliant with protection of private health information involving proper timing of inquiries, proper sequestration of medical information from employee records, and avoidance of acquisition of genetic information. FFD testing must be based on job necessity and must avoid discrimination.

2. **Valid**: FFD evaluators must ensure that any medical and/or functional test that can result in an adverse action against an employee is job related and performed for business necessity. Work-simulated functional tests should never exceed essential job demands.

3. **Reliable**: Testing methods that can result in any adverse action taken against an employee must have both intertester and intratester reliability to meet EEOC standards.

4. **Safe**: Testing methods must be standardized and conducted in a way that minimizes any risk of harm to the test recipient.

5. **Effective**: Testing must be able to determine whether a person is able to perform the essential duties or functions of a job without posing an imminent risk of injury to him- or herself, coworkers, and/or the community. Testing should identify health problems, measure preexisting impairments, and assess related functional inabilities in a way that provides an accurate means for the employer to assess the availability of reasonable accommodations for the person. The FFD exam can be instrumental in helping employers conduct accommodation reviews by providing critical information about actual work-related functional limitations. Therefore, FFD evaluations using job-simulated functional testing (for example, lift testing) should document carefully the maximum functional abilities to perform a job task even if the individual fails to meet the job requirement(s).
Administrative Guidelines

Although the primary burden of legal compliance in FFD programs falls on the employer, it is beneficial, if not imperative, that the evaluator help employers understand how to correctly implement and manage FFD programs for their employees. Administrative guidelines for implementation of an FFD program include:

1. Identification of Essential Job Demands: Prior to conducting an FFD examination, the evaluator should ask the employer for either a list of essential physical demands for each job to be tested or more detailed functional job descriptions containing this information. FFD evaluators must understand the essential physical demands of a job to render accurate opinions about work ability and to establish valid pass/fail test criteria when using any job-simulated functional capacity tests.

2. Creation of Job-Specific Test Protocols: The FFD evaluator should obtain or create FFD testing protocols that are specific for each job. For certain jobs and positions, the evaluator needs to be aware of federal FFD requirements (such as those of the Federal Motor Carrier Safety Administration, OSHA, Federal Aviation Authority, and U.S. Coast Guard) for certain jobs.

3. Validation of Test Protocols: Before rolling out FFD tests for an employer, the evaluator may find it beneficial and legally protective to assess the validity of any job-specific functional capacity tests being used. One way to test validity of these tests is simply to conduct the FFD tests on a sample of experienced current employees in each job, who in turn fill out questionnaires about how closely the test mirrors their work requirements. This method is common in heavy-manual-labor industries, such as energy and shipping, that typically test large numbers of employees. In short, pass/fail functional tests must closely resemble job duties. Any other tests, such as VO 2 max tests, push-ups or sit ups, planking, or isometric strength tests, are only defensible if they can logically predict a worker’s abilities.

These recommendations, aside from helping to form a productive and healthy workforce, are also important in avoiding discrimination. For example, using 30-pound weights in a test for a woman who lifts only 20 pounds at work could be easy grounds for a lawsuit. Functional testing not based on job-task simulations may also lead to disgruntled job applicants who do not perceive a connection between the test and job demands. The withdrawal of a job offer based on a test failure that is not based on workplace reality is more likely to trigger an EEOC action than a test failure based on a valid functional test.

If functional tests are not needed, validity rests on the evaluator’s professional expertise, and no further validation requirements need to be fulfilled. For example, an FFD evaluator conducting an examination may discover through observation and/or X-rays that a recipient has a spinal defect that would expose him or her to a direct threat of harm if placed in a job requiring heavy lifting. The opinion rendering the person unfit to work (unless reasonable accommodation can be provided by the employer) is considered valid.

4. Administration of FFD Tests: When possible, administration of FFD tests using job-simulated functional testing, unless based on federal guidelines, should begin after the functional test protocols have been validated. Before administering post-offer job-specific functional tests, it is preferable to conduct a thorough medical history, physical examination, and any special diagnostic
tests (such as radiographs, MRI, urinalysis, VO2 max, or pulmonary tests). Vital signs should be monitored during physically demanding tests for safety. Pass/fail criteria for the FFD test should be clearly defined and followed in a consistent manner.

5. **Reporting FFD Test Outcomes:** The FFD evaluator should determine how results of the FFD examination will be sent to human resource departments, such as by encrypted email or fax. Regardless of choice, the mechanism of communication should be secure. As with all medical records, medical information obtained through the FFD process and sent to the employer must be kept confidential and kept in a secure file separate from other employee records. When possible, it is advantageous for the FFD evaluator to maintain FFD reports on file for the employer.

Last, policies and procedures should be established for retesting anyone who fails an FFD test or is unable to complete it. When a job is available, the door should never be closed to retesting applicants who have been previously denied employment but have since corrected functional deficits or resolved medical conditions prohibiting their employment.
CHAPTER FIVE
SAFETY IN THE WORKPLACE
In the United States, as in many countries, employers are subject to occupational safety and health regulations to protect employees from work-related incidents and illnesses. The primary disciplines responsible for ensuring that these regulations are met are occupational safety, industrial hygiene, ergonomics, and occupational medicine.

Occupational safety professionals are responsible for implementing procedures and techniques to identify, eliminate, or control the risk of incidents in the work environment. Industrial hygienists anticipate, recognize, evaluate, and control potential hazards, such as chemical agents, physical agents, and biohazards. Ergonomists, also called human engineers, study people’s interaction with their work environment. Their primary goal is to improve performance by adapting the work environment and work tools to the human being.

Occupational health providers perform several roles: they develop prevention programs (including surveillance), evaluate employees’ fitness for duty and establish the need of restrictions, and advise employers when health-related labor decisions should be taken.

Implementation of an occupational safety and health management system is a win-win proposition for workers and employers. It protects workers by preventing work-related injuries and illnesses, improves workers’ morale and labor relations, saves costs (including health care and workers’ compensation), decreases absenteeism and turnover, improves productivity and quality, and mitigates liability repercussions.

This section of the guide addresses the unique employer-occupational medicine relationship, focusing specifically on three key workplace safety issues: 1) safety-sensitive jobs and workers’ responsibility for their own safety as well as the safety of coworkers and the general public, 2) drug-free workplaces as a means to prevent incidents due to substances that alter the function of the brain, and 3) a review of impairment in the workplace, with strategies to identify and manage it.

The fourth section of this chapter discusses the challenges and rewards for health professionals serving the workforce. To succeed in having a healthy workforce, employers and occupational health providers must establish common objectives and develop relationships, based on trust, collaboration, and fluid communication. Occupational health providers must be trusted with sensitive information, and in turn—and in compliance with HIPPA privacy regulations—they must communicate sensitive information to employers. They must also keep employers informed about hazards in the workplace and risks to which employees may be exposed and help them understand the importance of investing in occupational health and safety risk management.

To succeed in this role, occupational medicine providers must learn to navigate an unfamiliar environment and work with a variety of stakeholders (such as workers’ compensation representatives, insurers, and lawyers). The providers’ ability to manage these roles effectively is critical, ensuring that important decisions affecting both workers’ livelihoods and workplace safety and productivity are based on sound scientific evidence and medical judgment.
Reference

Halonen, Jaana I et al: Collaboration between employers and occupational health service providers: a systematic review of key characteristics BMC Public Health, 12/2017, Volume 17, Issue 1
Almost all forms of human endeavor involve risk, including the risk of physical harm. Even such simple tasks as driving a nail or using a screwdriver court potential injury. To maintain a workforce at maximum output, an employer needs to take steps to reduce, if not eliminate, that risk. For the most part, minimizing risk involves passive safeguards, such as barriers or housings around hazardous areas or moving parts to prevent injury; protective equipment to reduce exposure to potentially harmful substances or environmental conditions; or active training to ensure that dangerous performance errors are avoided. Not all potential for harm, however, can be addressed through such interventions.

In some jobs, the risks are broader. Not only is the individual worker put at risk if he or she makes an error: others can face harm, or even death, as well. Therefore, definitions of what constitute safety-sensitive jobs focus not only on workers’ responsibility for their own safety but also for the safety of other workers and the general public. Because of the possible risk to other workers and the public, health care professionals must ensure that those whose work involves safety-sensitive activities are not impaired either physically or mentally, because even very minor impairment can have dire consequences. Let’s assume, for example, that the difference between a loaded semi-trailer truck either hitting or missing another vehicle is approximately one-half inch. For a vehicle traveling at 30 miles per hour, a difference of less than one millisecond in reaction time—hardly perceptible to the driver—can have devastating consequences.

What types of jobs are safety-sensitive? While there is no exhaustive list, in general, those that involve handling of toxic, corrosive, or explosive materials; that involve rapid decision making amid quickly changing situations; or that have the potential to jeopardize the life and limb of the worker and/or others should be considered safety sensitive. An extensive list of high-risk, safety-sensitive jobs is available on the Connecticut Department of Labor website at: https://www.ctdol.state.ct.us/wgwkstnd/highrisk.htm. Examples range from nursing and handling radioactive materials to piloting commercial aircraft or semi-trailer trucks to working as a flagman during highway repairs or as a van driver for wheelchair transport. Particularly when prescribing medication that may impair an individual or diagnosing or assessing a potentially impairing problem, it is important to ask what the individual does for a living, to be sure that there is little or no likelihood that the medication or diagnosis will cause the worker to have a potentially hazardous lapse.

**Fitness to Perform Duties**

In general, medical practitioners evaluating whether an individual is fit to perform tasks of limited safety sensitivity, or an injured worker is fit to return to such work, must consider whether there is evidence that the worker is significantly impaired. Most of the time that simply involves being sure that the worker has the physical strength, endurance, and physical mobility to perform the tasks at hand. Sometimes, in the case of a contagious ailment, providers must assess the worker’s potential to infect others, as well. However, for safety-sensitive tasks, there are other impairments to consider:
• **Sensory Perception:** This factor primarily involves sight and hearing. A worker who cannot hear an alarm, for instance, is at increased risk of an accident. For example, the driver of a large commercial vehicle needs to have enough peripheral vision to be able to see the other vehicles in lanes nearby. Someone suffering from migraines with a visual aura that impairs vision can also become a hazard in many situations. To avoid a potentially harmful situation, the worker must be able to perceive an evolving hazard.

• **Judgment:** Once a worker has noticed a potentially harmful situation, it is critical to identify precisely the potential harm and to take the proper action to ward it off. An individual having an episode of mania, for instance, may misjudge the potential for harm. Someone with a cognitive impairment may be unable to formulate a plan to avert it or may not be able to formulate and execute the plan rapidly enough.

• **Alertness:** Drowsiness is a significant risk factor in errors of performance and judgment. Sleep deprivation, of course, is a major contributor to alertness issues, but many medications, such as some antihistamines, all benzodiazepines, some medications for seizure disorders, most cough syrups, and some antidepressants, among other medications, can also reduce alertness. Any provider prescribing a medication that may affect alertness should identify the patient’s job, to assess whether the medication will introduce a safety risk.

• **Attention:** This is distinct from alertness. Even an alert worker can be distracted from a task and make an error. An asthmatic who has a sudden onset of bronchospasm, for instance, can be distracted while looking for a rescue inhaler. (Imagine, for example, an individual piloting a semi-trailer truck at high speed on a busy highway foraging in a glove compartment to find the needed inhaler.) Any condition that can suddenly become uncontrolled has the potential to distract an individual, increasing the risk of a significant error.

• **Consciousness:** Unexpected, even transient, losses of consciousness can be, and often are, devastating in safety-sensitive tasks. Seizure disorders, of course, are a particular risk. However, severe hypoglycemia in diabetics or a sudden, poorly perfusing increase in heart rate among those with marginally controlled atrial fibrillation or paroxysmal atrial tachycardia also merit concern.

• **Reaction Time:** Of all the issues listed here, this is perhaps the subtlest and the hardest to detect. Sleep disturbance, sedating drugs, even some analgesics can cause minor increases of reaction time without causing any noticeable drowsiness.

These concerns should not bar individuals with such conditions from safety-sensitive employment. However, medical providers who evaluate these patients should be sure that:

- the medical condition is well controlled before such activities are undertaken
- the worker is reliable in taking necessary medications
- the likelihood of the condition or medication causing any of the above impairments is minimal to negligible.
History of Drugs in the Workplace

During the 1980s, fatalities from the crash of an airplane on the deck of the USS Nimitz (1981) and from the Chase, Maryland, train crash (1987) were attributed to substance use. These events in particular triggered the Reagan administration to propose legislation to ensure that the workplace was drug free. The federal Drug-Free Workplace Act of 1988 and the Anti-Drug Abuse Act of 1988 were followed by legislation and regulation at both the state and federal levels, encouraging and outlining steps to ensure that the workplace remained drug free.

The drug use that these laws attempt to prohibit involves not prescription medications, used as prescribed by the intended individual, but rather illicit, or “recreational,” substances—used for their pleasurable effects—or legitimately prescribed medications diverted from either their intended use or recipient. As a group, these substances temporarily but significantly alter the function of the brain.

For employers, concerns about such substances extend beyond the impairment caused by acute intoxication. Chronic use can also have long-term effects, and with some substances, there is a period after use during which the neurochemistry remains distorted, leaving the individual functioning at a subpar level. Cocaine is an example. During acute intoxication, the individual feels energized, but when the intoxication wears off, the user experiences a significant letdown, exhibiting a sluggish, depressed mental status. The intense tightening of blood vessels, especially those supplying the heart, associated with cocaine use has been seen to result in heart attacks, which can result in permanent impairment and occasionally death. Other substances alter judgment (such as sedatives, stimulants, or some antipsychotics), reaction time (sedatives and some anti-seizure medications), or accurate perception of the environment (hallucinogens). None of these outcomes is beneficial to the well-being or productivity of the workplace or to individuals working in safety-sensitive environments.

Deterrent Versus Detection

Whether workplace-based screening for substance-use functions as a deterrent or a means of detection depends, at least in part, on the consequences suffered as a result of detection. The more severe the consequences of a positive test, the more it is expected to function as a deterrent. Many companies have a policy calling for the immediate termination of an employee who has tested positive on drug screening; others suspend workers from safety-sensitive duties, often for prolonged periods of time. Still other companies, however, are more lenient, asking only that the employee work with a substance abuse professional and undergo increased monitoring. The more severe the penalty, the greater the potential for losing an employee who is valuable and hard to replace. There is both benefit and risk in detection and deterrence; both need to be carefully weighed in establishing a company’s policy on drug screening.

One of the greatest problems in detection is the length of time that the markers of some substances remain in the body. Although cocaine is present in the body for only a short period of time, the benzoylecgonine, the metabolite used for detecting cocaine use, can be present for up to
three days after drug use. As for marijuana, the metabolite used to identify it can be detected in the urine for up to a month after the last use. Clearly, these tests fail to document recent use, intoxication, or impairment, instead documenting drug use at some time in the not-too-distant past. These tests differ greatly from breath alcohol, which does indicate recent use and does imply intoxication and impairment.

Because urine, hair, or oral fluid sampling detects any recent use of the substances for which the testing is done, it functions as a deterrent to drug use both in and outside of the workplace. The degree to which such testing deters drug use is related to both the frequency of testing and the consequences of testing positive. The more frequently testing is done, the more likely it is that any use will be detected, and thus potentially the greater the deterrence—as well as the cost to the company. Rapid drug screens are very effective at detecting any drug use and are less costly than more specific tests, but they are also prone to mistake other, legitimate, substances for the targeted drugs. Employment decisions (such as hiring, discipline, or firing) should never be based purely on a non-negative rapid drug screen; non-negative samples should be sent to a lab certified for drug screening, and the screening test confirmed before any steps are taken. In many federally regulated industries, non-negative drug screens must be reviewed by a physician, called a medical review officer, specially trained in handling such results, and the donor of the specimen must be given a chance to provide a medically legitimate reason for a non-negative result. Even those non-negative drug screens not subject to federal regulation should be reviewed by such a professional.

Impact on Productivity

On the whole, use of recreational substances is believed to increase worker absenteeism, “presenteeism” (that is, being present at the workplace but unable to function at full capacity), and injury in the workplace. Clearly, all of these issues decrease productivity and present significant concerns for safety-sensitive tasks, where impairment can increase the risk of harm to self or others.

An excellent discussion of marijuana use in the workplace can be found in the American College of Occupational and Environmental Medicine’s position paper on the subject, which can be found at: https://www.acoem.org/uploadedFiles/Public_Affairs/Policies_And_Position_Statements/Guidelines/Guidelines/Marijuana%20JointGuidance%202015.pdf.

Effects of Legalization of Medical or Recreational Use of Marijuana

At the time of writing, marijuana laws are in a state of flux, with multiple states legalizing it for medical use only and a growing number of states legalizing it recreationally. It is therefore important to be clear about the laws that apply to the place of a provider’s practice, not only for the provider but also for the entity ordering the drug screen. Workers being tested must also be made clearly aware of the corporate policies concerning marijuana. Regardless of marijuana’s legality, in some states, employers can require that their employees be free of evidence of marijuana use as a condition of ongoing employment. In other states, the law forbids workplace policies that regulate outside behavior. Given the persistence of the markers of drug use beyond the point of clear intoxication or apparent impairment, drug testing in the workplace becomes much more complex in those states: blood tests are required to document intoxication or impairment. Determining that a tested individual is intoxicated or impaired also requires agreed-upon standards to indicate intoxication or impairment, something that is lacking for most drugs.
Complicating this issue further, the federal government and its agencies have ruled that certain professions (including pilots, school bus drivers, truck drivers, train engineers, subway operators, aircraft maintenance personnel, transit fire-armed security personnel, ship captains, and pipeline emergency response personnel, among others) must test negative for marijuana use, no matter what state is involved or that state’s laws about marijuana use. For health care personnel seeking to understand these highly variable laws, state departments of public health or legislature websites are a good starting point.
The Americans with Disabilities Act (ADA) broadly defines “physical or mental impairment” as any physiological disorder, disfigurement, or anatomical loss affecting one or more body systems. The definition also includes any mental or psychological disorder, such as intellectual disability, organic brain syndrome, emotional or mental illness, and specific learning disabilities. Impairment at work increases “presenteeism,” which is defined as workers being on the job but, because of illness or other medical conditions, not fully functioning.

Impairment in this section refers primarily to neurocognitive reduction in performance—generally a temporary condition resulting from medication or substance use or from an internal or external stressor. In safety-sensitive positions, this situation can be dangerous, but in all positions, it can reduce productivity.

Often, neurocognitive impairment is thought to be the result of drug or alcohol use (used legally or illegally). The increase in the use of controlled substances, novel psychoactive substances (so-called “designer drugs” that may be legal and unregulated), and cannabis has indeed contributed to the complexity of impairment in the workplace. But workers may be impaired for various reasons, including many that are temporary or short-term and unrelated to substance use. Factors that may distract a person from focusing on his or her tasks can be related to family or relationship problems, mental or physical fatigue, extreme environmental conditions, or other situations.

Examples of potentially impairing conditions with neurocognitive effects include:

- physical conditions such as chronic pain; fatigue from inadequate sleep, working long hours, shiftwork, or multiple jobs; intoxication from substances such as alcohol or drugs; use of sedating medications; or a medical problem that may not be diagnosed
- depression, anxiety, hypomania, addiction, compulsive disorders, attention deficit, or posttraumatic stress disorder
- severe stress from a personal tragedy, such as a death in the family, home robbery, or home fire; a relationship or financial crisis; care of a child, elder, or someone with special needs; and even preparation for an activity such as an exam or a wedding
- work-based trauma such as conflict with an employer or coworkers, sexual harassment or bullying, and extreme environmental conditions such as cold, heat, wind, or noise

Some of these issues may be chronic and others only intermittently problematic. If stressors become overwhelming or otherwise affect the worker to the point of impairment, it is important that they be addressed. If the worker has a safety-sensitive position, continuing to work as usual when impaired can present an unreasonable risk. But, even if the worker does not hold such a position, impairment can negatively affect worker health and productivity. Impairment is therefore an important issue for employers, who have safety responsibilities as well as a vested interest in having workers functioning at their highest potential. Individual workers, coworkers, supervisors, safety officers, human resource officers, and occupational health providers each play a role in identifying impairment, and in taking action.
Identifying Impairment

Impairment in the workplace is identified by behavior—whether witnessed directly by a supervisor or by another employee. The closer someone is to a worker, the more opportunity there is to notice subtle changes, although coworkers may be hesitant to suggest that a colleague is impaired. Sometimes there are immediate signs; other times there is a concerning pattern of behavior. Whether it is falling asleep while working, slurred speech, increasing absenteeism, mood changes, or persistent errors, impaired workers often have more than one visible sign.

Some signs of impairment are listed below. The behavior may be more significant if it represents a noticeable change from previous behavior.

- Odor of alcohol or drugs, glassy or red eyes, unsteady gait, slurred speech, or poor coordination
- Personality changes, erratic behavior, or mood swings; increased interpersonal conflicts or overreaction to criticism
- Changes in personal hygiene, such as not bathing or washing clothing
- Family disharmony, evident through a change in how the worker speaks of family members
- Inappropriate verbal or emotional response
- Isolation from colleagues
- Lack of focus or concentration and forgetfulness
- Lying and/or providing implausible excuses for behavior
- Working in an unsafe manner or involvement in an accident or incident
- Consistent lateness, absenteeism, or reduced productivity or quality of work
- Falling asleep while working
- Frequently leaving the workspace
- Significant and persistent errors or sloppy, illegible work
- Non-compliance with policies
- Doing enough work to just “get by”

Drug Testing Programs

Workplace drug-testing programs, discussed previously in this chapter, are deterrents, but they are not intended to identify currently impaired workers or all workers using illicit substances. A worker’s positive drug test provides objective data showing that drugs have been used; subsequently, the occupational health provider may be asked to evaluate an individual for impairment. But drug testing reveals use, not impairment; the only test that correlates to impairment in a relatively consistent manner is blood alcohol content. Workplace drug testing policies should acknowledge this principle, so that workers and unions are aware, prior to testing, that human resources actions will be based on evidence of use alone. If the occupational health provider is asked to determine impairment following a positive drug test, a comprehensive evaluation, as opposed to the forensic test alone, is necessary.

Strategies for Managing Impairment

Employers should collaborate with employees, occupational health and safety staff, and union representatives (if applicable) to design an impairment policy that outlines the acceptable code of behavior and level of safety performance for the workplace. The ADA protects workers from
discrimination for alcoholism or drug addiction, but it does not protect them from illicit drug use or alcohol intoxication while at work. The ADA also forbids employers from prohibiting prescription medications. However, the ADA does allow employers to require medical examinations that can include a review of prescribed medications when there is evidence of a job performance or safety problem—as long as the policy applies to all employees in the same job category. The workplace impairment policy should include evaluation protocols for potentially impaired workers (in the occupational health clinic versus the emergency department, for example) and how impaired workers will be sent home. A supervisor should consider whether the impaired worker requires a medical evaluation prior to leaving work, and how he or she is going to get home safely.

It is not uncommon for employers to send employees to an occupational health clinic for an impairment evaluation without providing sufficient information on which to base the evaluation. This practice is not helpful to the occupational health provider, especially if he or she is unable to reach the employer for additional information, and ultimately can diminish the usefulness of the health care provider’s report. The employer should provide an explanation of the behavior and incident that prompted the evaluation, including the results of drug testing, if performed at the time of suspected impairment. The evaluation should characterize the use of potentially impairing substances (including therapeutic use, abuse, addiction, or other misuse), acceptability of continued use of any prescription medications in the workplace, and any recommendations for follow-up for medical conditions that are of safety concern.

Only when these steps are taken can the provider inform the employer of whether the worker is safe to return to work and capable of carrying out the essential functions of his or her position.

Managing Workforce Performance

When potential problems with worker performance arise, it is best for supervisors to communicate with their employees in a direct and timely manner. Performance management conversations can be difficult, so it is best if they are planned ahead of time, even if they do not necessarily go as planned. If the supervisor thinks that medical issues may be a factor in a worker’s performance, conferencing with an occupational health provider to prepare for the conversation can be helpful. During the conversation with the worker, supervisors should focus on observed behavior with specific examples. A single event does not necessarily indicate impairment, but collective incidents can indicate a significant issue. Rather than take an accusatory approach, supervisors should inform the worker of safety concerns for the individual as well as for others, and even for equipment, if relevant. In most cases of drug or alcohol addiction, initial denial of the problem is common. Taking an approach that is not threatening or judgmental can help put employees at ease.

Ensuring Health and Productivity

Impairment is not just an issue for workers in safety-sensitive positions. Impaired employees can cause a lot of damage in an office settings as well—for example, producing erroneous reports that can have a tremendous effect on a company. Impaired workers driving to meetings are the company’s liability.

Presenteeism can cut individual productivity by one-third or more, which can be a tremendous invisible expense to the employer.
When considering the range of ways in which workers can be impaired, providers and employers should take a broad perspective, understanding the many possible causes of impairment besides just substance use. By paying close attention to stressors that affect all workers at times, and making proactive decisions in the workplace, employers can improve safety and reduce presenteeism. In the short term, making this effort may appear to be an inconvenience or more work, but overall it improves the health of the workforce, increases productivity, and reduces mishaps.

Reference

Provider-Worker Interface

Jerald Cook, MD, MS, FACOEM

The Unique Medical-Employer Relationship

Occupational medicine is where primary care meets workers in the workplace. Some occupational medicine clinics are located at a worksite or are exclusive to a corporation. In this environment, the occupational medicine provider builds relationships with the company’s staff and may even become one of the staff, caring for fellow workers.

Even if an occupational medicine clinic is not embedded in a corporation, it is still an extension of the work environment. The closer the occupational health provider works with the staff of a company, the greater the opportunity to provide preventive health services and to minimize employees’ time away from work for minor injuries and illnesses.

As a preventive medicine specialty, occupational medicine is population-centric, and here, the population is composed of workers. The provider may examine and treat an individual, but the individual is representative of the larger group. If one individual is introduced to a hazard, whether physical, biological, chemical, or psychological, it is likely that others are also exposed or at risk of being exposed to the same hazard. When an occupational health provider identifies a worker who is injured or ill from a hazard, he or she needs to work with employers to protect other employees.

A Multifaceted Role

Primary care providers fill the majority of occupational health provider roles. These providers are trained for, and accustomed to, the patient being the primary customer. Analogous to parents being customers in a pediatric clinic, employers are customers in an occupational medicine clinic, in that they have a vested interest in the outcome. This situation can be very challenging to a well-meaning primary care provider who was not trained to practice medicine this way. Dealing with privacy concerns and uncertainty about what to discuss with an employer, and understanding who in a workers’ compensation program has a “need to know,” can be difficult. The primary care provider is trained to be a patient advocate first, but when faced with multiple stakeholders involved in a workers’ compensation claim—a necessity when identifying the cause of a complaint, dealing with insurance-carrier provisions, and fielding employer inquiries—this obligation is complicated and not always straightforward.

Although most occupational medicine clinics are independent entities that contract services with employers, they can be perceived as agents of corporate human resources departments, even if their health care providers are not embedded in the employers’ physical facilities. The interaction of employers with the occupational health provider may appear inappropriate if this unique relationship is not well understood. The focus of the occupational health care provider is on the patient, even though the provider simultaneously serves as an advocate for the employer. While this role may seem contradictory, being a patient’s advocate does not mean that a provider must be antagonistic toward the employer. The intermediary role is not so different from other roles that primary care providers play. For example, when working with a patient, they will often take into consideration the entire family’s needs, or when working with an HMO, will consider its limits and policies when providing patient care.
Provider-Employer Communication

Occupational health providers perform myriad services for workers, including injury care, employee medical certification, and medical surveillance. Some of these are mandated by OSHA or other regulatory agencies. Some are human-resource directed, and others may be a part of an employee benefit package. At times, supervisors direct workers to be seen in an occupational health clinic. Following a visit, the occupational health provider is obligated to communicate the results of the evaluation to the supervisor.

Communication of Health Information

Occupational health providers are authorized to handle sensitive information that can affect employment, but only rarely do employers need specific health information to make supervisory decisions for their workers. Typically, the employer requires only information that provides an understanding of function, risk, safety, and hazards, and providers may produce it only if it is free of health information, or with a signed release from the employee, according to HIPAA privacy rules.¹

When human resources staff handle protected health information, they must keep it separate from general employee files and under extra security. The best solution is to keep employee health records in the occupational medicine clinic—with the occupational health provider serving as the conduit between the employee and employer, providing only information that is relevant to the position.

In the event of a workers’ compensation claim, however, disclosure of the minimum necessary health information is permitted without individual authorization to the parties involved in the claim, which could include the employer’s human resources department. This exception to HIPAA is needed to allow payment and treatment for injured workers. State workers’ compensation interpretations vary in terms of the types of information that health care providers must convey, but privacy laws still apply, and disclosure must consist of the minimum necessary information.

Communication between the occupational health provider and employer improves when there is a good understanding of what employers want and need to know. Employers need to know whether the worker is able to perform the essential job functions or if there are any limitations or safety concerns.

It is a best practice to communicate worker health information to employers in terms of function rather than diagnosis. The provider may then recommend activity restrictions that allow recovery from an injury or prevent exacerbation. In the case of a worker with a sprained back, for example, the health provider should report not the diagnosis or treatment, but rather that the worker should not lift or carry more than 10 pounds for one week. Communication of the prognosis to the employer is also important because it allows it for planning of job placement and accommodations.

An open working relationship allows the occupational health provider to be aware of the employer’s concerns and the information the company needs to operate safely and within industry regulations. Minor misunderstandings and miscommunication can have large impacts on both the business and workers’ health. Therefore, it is helpful to quantify any restrictions and use standard terminology in workers’ compensation and disability medicine. For example, a provider might recommend that a worker perform a function “rarely.” Rarely is not described by the Department of Labor, and a supervisor or human resources officer may not know how to manage this
Although primary care providers may feel comfortable using everyday terms, employers must manage workers within strict employment laws, and such terms become difficult to manage.

Occupational health providers may also be the first to hear of concerns in the workplace related to abuse, trauma, or unsafe conditions. Even though safety and human resources departments are tasked with protecting employees, certain barriers may prevent some employees from approaching them. An employee who is unsure of where to turn for help may look to the occupational medicine clinic because he or she trusts the health care system and may have developed a relationship with the provider. This occupational medicine role is essential for the wellness of the worker as well as for the employer. Safety and occupational medicine should work together to identify and investigate troubling allegations.

Occupational health providers should also be familiar with available employee assistance programs and collaborate with human resources to refer workers to these services when needed. The occupational medicine provider can also be very influential in advising employers when there are management decisions to make related to the health of an employee.

**Transitional Duty Programs**

Employers and providers understand that returning to work with restrictions, rather than remaining off work, accelerates returning to full function and also minimizes overall workers’ compensation costs.

Early return to work also can be physically and mentally therapeutic for the injured worker. Remaining out of work often has negative psychosocial effects, as well as reduces the injured worker’s overall activity level. This leads to physical deconditioning and creates new social and behavioral norms as the worker becomes accustomed to being out of work.

Even though workers’ compensation systems are no fault—meaning that benefits are paid regardless of who is responsible for the injury—many workers will seek legal representation to obtain care and compensation. Occupational health providers who maintain a positive relationship with the employer can be instrumental in ensuring that an injured worker gets the assistance he or she needs, which may reduce the injured worker’s reliance on legal representation.

With representation, an injured worker often receives advice from an attorney whose incentives and strategies for rehabilitation may be very different from those of a collaborative team formed by the worker, employer (including supervisor, human resources officer, and safety officer), insurance provider, and occupational health provider.

The occupational health provider may act as a mediator or liaison with rehabilitation services and the injured worker’s employer to facilitate workplace accommodations and develop a strategy to return to work. Sometimes these providers are employed directly by insurers, the injured worker’s legal representative, or the employer. The work demands of health care providers within the workers’ compensation system can be significant, because they may be required to perform a number of these roles simultaneously while managing patient care. In addition to understanding specific injuries, occupational health providers should understand the work environment, how
injuries occur there, and how workers are expected to perform when they return with restrictions.

Most injured workers recover and return to work fairly quickly. It is estimated that 80% of workers’ compensation costs are expended on 20% of workers who have long-term claims. It can be difficult to predict which injuries will take longer to resolve, but when a worker is initially seen, and with every follow up visit, he or she should be prepared for eventual discharge and return to full duty.

Early return to work programs can be very beneficial to rehabilitation, reducing the risk of delayed recovery. These programs are usually designed for workers who were injured on the job, rather than those with non-industrial injuries, although they can benefit both groups in reducing disability and promoting return of function. These programs offer modified work duty until the injured worker is able to resume full duties, but they are not without challenges. For small employers, it can be financially difficult to have a worker in a modified role that is less productive. Moreover, employees may not be agreeable to assigned tasks if they feel they are being given menial work. The social dynamics of returning to work with modified duties can be a problem for the returning worker, who can face resentment or even hostility from coworkers. Workers without obvious injury may lose credibility, accused of being lazy or cheating the system when provided accommodations for work restrictions.²

The scientific evidence regarding return to work programs is lacking, but there is an abundance of research regarding injured athletes returning to the sport. All humans are in essence athletes, and in the case of injured workers, their jobs are their sports. Optimum performance is of course ideal for both productivity and job satisfaction; however, it may not be the immediate goal of a return to work program. Rehabilitation is a stepwise process, and in all stages of recovery, the occupational health provider needs to be cognizant that though rest may seem beneficial, it leads to deconditioning, which makes rehabilitation more difficult. Following a rest period, when there is an increase in activity, injured workers (and athletes alike) naturally feel discomfort because the injury does not vanish with rest, and the worker now has to overcome a deconditioned state. Returning an injured worker back to work, even with modified duty, as early as possible, limits the amount of rest and reduces the risk of this problem.

References

CHAPTER SIX
OCCUPATIONAL HEALTH: U.S. WORK LAWS AND REGULATIONS
Introduction

Numerous laws govern the safety and health of workers in the United States. Many agencies create and enforce worker safety and health regulations. Jurisdiction of these agencies and applicability of their regulations can be confusing. And, compliance can seem like an overwhelming task. This chapter provides a broad although not comprehensive overview of factors employers should consider when developing a safety and health management system; it is not comprehensive.

♦ Occupational Safety and Health Administration: An Overview

Beau Braswell, JD

Congress passed the Occupational Safety and Health Act of 1970 (OSH Act) to prevent workers from being killed or seriously harmed at work. This federal law governs safety and health in the private sector and federal government. To further its objectives, the OSH Act created the Occupational Safety and Health Administration (OSHA) and the National Institute for Occupational Safety and Health (NIOSH).

NIOSH, a federal research agency, is part of the Centers for Disease Control and Prevention within the U.S. Department of Health and Human Services. It is not a regulatory agency but rather promotes productive workplaces through worker safety and health research. The NIOSH website is a good source of free, high-quality workplace safety and health resources (publications, training, data, statistics, journals, and guides). NIOSH resources can help employers and health care professionals meet and exceed OSHA requirements.

OSHA, a federal enforcement agency, is part of the U.S. Department of Labor, which sets and enforces protective workplace safety and health standards. OSHA also provides training, outreach, education, and compliance assistance. OSHA standards are rules designed to protect most private-sector and federal government employees. State and local government workers and sole proprietors are not covered by federal OSHA. To dispel a common misconception, small employers with 10 or fewer employees are still covered by OSHA. But, these employers are partially exempt from certain OSHA requirements, such as recordkeeping, and are typically not subject to programmed or targeted inspections.

OSHA standards require employers, among other things, to provide fall protection, prevent trenching cave-ins, prevent exposure to infectious diseases, ensure safety of workers in confined spaces, prevent exposure to harmful substances, put guards on machines, provide respirators and other safety equipment, and give training on workplace hazards. Medical screening and surveillance are required when employees are exposed to certain hazards such as noise, lead, silica, asbestos, and benzene. The appendices of certain OSHA regulations include screening and surveillance procedures and guidelines (mandatory and non-mandatory). In addition to keeping in mind OSHA requirements, primary care providers should consider potential workers’ compensation liabilities when developing medical screening and surveillance plans. ACOEM guidance documents can also help tailor appropriate, evidence-based protocols.

Employers must also comply with the General Duty Clause of the OSH Act. This clause requires employers to keep their workplaces free of serious recognized hazards. OSHA can cite the General Duty Clause—referred to as Section 5(a)(1)—when certain conditions exist and employees are
exposed to a serious hazard, even if no specific OSHA standard applies to the hazard.

Violation of [OSHA standards](https://www.osha.gov) or the General Duty Clause can result in substantial monetary penalties. Violations can even result in criminal sanctions, including jail time for employers. Inspection histories, including copies of citations, are available to the public under the Freedom of Information Act ([FOIA](https://www.federalregister.gov)). Some employer-specific information is also available through OSHA’s [Establishment Search](https://www.osha.gov) webpage.

**Exposure and Medical Records**
OSHA requires employers to retain relevant worker medical and exposure records for the duration of employment plus 30 years. Employers cannot charge employees for access to these records; thus, it is a best practice to digitize and archive them. Many employers and occupational medicine providers use HIPPA-compliant software to create, manage, and store electronic medical records. More information on access to employee exposure and medical records is available at [29 CFR 1910.1020](https://www.osha.gov).

**Helpful Links**
OSHA [A-Z Index](https://www.osha.gov) [OSHA Publications](https://www.osha.gov)
OSHA [Laws & Regulations](https://www.osha.gov)
OSHA [Medical Screening & Surveillance](https://www.osha.gov)
OSHA Recordable Injuries and Illnesses
Luke P. Lee, MD, MPH, CIME, MBA, CPA

Since the passage of the OSH Act, fatality and injury rates have dropped markedly. Although accurate statistics were not kept until OSHA’s founding, it is estimated that in 1970, about 14,000 workers were killed on the job. That number fell to approximately 4,340 in 2009. During approximately the same period (through 2017), U.S. employment almost doubled to more than 130 million workers at more than 7.2 million worksites. After the passage of the OSH Act, the rate of reported serious workplace injuries and illnesses declined from 11 per 100 workers in 1972 to 3.6 per 100 workers in 2009, and it continues to decline. One way that OSHA tracks this trend is through its employer recordkeeping and reporting requirements.

Currently, most workplaces, including medical clinics and hospitals, with more than 10 employees are required to keep a record of serious work-related injuries and illnesses. This information helps employers, workers, and OSHA to evaluate the safety of a workplace, understand industry hazards, reduce those hazards, and implement worker protections to prevent future injuries and illnesses at millions of jobsites across the country.

OSHA mandates that most employers use a form called the OSHA 300 log to record certain injuries; records must be maintained at the worksite for at least five years. Each year between February and April, employers must post a summary of the injuries and illnesses recorded the previous year. If requested, copies of the records must be provided at no charge to current and former employees, or their representatives.

Because reporting “everything” would pose an undue burden on employers, OSHA specifies that only certain “serious” injury events, such as bone fractures or medical conditions requiring prescription medication, be logged and reported, thus the common expression “OSHA recordable incidents.” Certain very serious injuries require separate reporting methods: employers must report any worker fatality within 8 hours and any amputation, loss of an eye, or worker hospitalization within 24 hours of occurrence.

Subtleties in the language that providers use to describe injuries, diagnoses, and/or choices of treatment can affect whether they meet the criteria for recordable events. For example, lidocaine injection for pain relief is recordable, but injection of the same medication to allow the provider to manipulate a wound and better examine it may not be recordable. In general:

- An injury that requires treatment by a licensed medical provider commonly is considered recordable.
- An injury that requires only basic first aid, which a non-licensed medical provider could independently administer, is commonly not recordable, regardless who administered the treatment or wrote the order.

OSHA regulations are not related to workers’ compensation or any other form of injury compensation payment. Although licensed medical providers do not make the recording decisions, their actions can significantly determine how the employer records an incident. OSHA mandates that specific decisions about whether to record an incident and how to classify it are at the sole discretion of the employer.
OSHA regularly updates its regulations and their interpretations. Please seek the most current regulations and/or interpretations.

**Recordable Medical Treatments Versus First Aid**
The following list is a general guideline as of April 2018 for OSHA-regulated employment sites. There are many variations, exceptions, and additions to this chart.

<table>
<thead>
<tr>
<th>Nature of Injury</th>
<th>Recordable Medical Treatment</th>
<th>Not Recordable First Aid</th>
</tr>
</thead>
</table>
| Cuts, lacerations, punctures, splinters, abrasions | ☐ Suture (stitches)  
☐ Dermabond application  
☐ Any prescription medication  
☐ Application of prescription cream, ointment, gel  
☐ Surgical debridement  
☐ Use of rigid splint | ☐ Butterfly-type wound closure tape  
☐ Nonprescription ointment, cream  
☐ Removal of foreign body by simple means  
☐ Removal of foreign body from the eye with swab or irrigation  
☐ Drilling of nail for pressure relief  
☐ Use of finger guard |
| Fracture, dislocation | ☐ Any diagnosed acute bone break or joint dislocation | ☐ No acute bony injury on X-ray or other imaging |
| Strain, sprain | ☐ Any application of rigid immobilizer, splint, or cast,  
☐ Almost all use of physical/occupational therapy services | ☐ Use of any soft dressing or support  
☐ Use of hot/cold compression  
☐ Use of massage therapy |
| Unspecified not feeling well | ☐ Therapeutic use of medical (IV) fluid or oxygen | ☐ Diagnostic use of fluid or oxygen (or use per protocol), not for symptom treatment |
| Loss of consciousness | ☐ All work-related loss of consciousness/syncope | ☐ Near-syncope, dizziness, light-headedness |
| Heat stress, dehydration | ☐ Therapeutic use of IV fluid | ☐ Any nonprescription oral fluid |
| Bruise, contusion | ☐ Therapeutic drainage of any body fluid | ☐ Diagnostic drainage of fluid  
☐ Hot/cold packs, soft wraps |
### Other General Guidelines

<table>
<thead>
<tr>
<th>Event</th>
<th>Recordable</th>
<th>Not recordable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medication</td>
<td>Recommended use of prescription medications</td>
<td>Any diagnostic use of prescription medication</td>
</tr>
<tr>
<td></td>
<td>Administration of prescription medication for treatment, including samples</td>
<td>Recommendation of OTC medications at OTC dose</td>
</tr>
<tr>
<td></td>
<td>Recommendation of OTC medication at a prescription dose</td>
<td></td>
</tr>
<tr>
<td>Medical examination</td>
<td>None</td>
<td>Use of any prescription medicine or device as part of a diagnostic process</td>
</tr>
<tr>
<td>Immunization</td>
<td>All immunization as a part of treatment</td>
<td>Any tetanus immunization</td>
</tr>
<tr>
<td>Work-duty restrictions</td>
<td>Restrictions that require a job transfer</td>
<td>Minor restrictions that allow the employee to stay at the same job</td>
</tr>
<tr>
<td>Days off</td>
<td>Any day off recommended by the provider after an injury, even when the</td>
<td>Day of treatment does not count as a day off</td>
</tr>
<tr>
<td></td>
<td>employee was not scheduled for work</td>
<td></td>
</tr>
<tr>
<td>Referral for additional</td>
<td>Chiropractor or most physical/occupational therapy</td>
<td>Referral, by itself, to any other specialist</td>
</tr>
<tr>
<td>treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise</td>
<td>Therapeutic exercise program</td>
<td>Massage, education about normal use of muscles or joint mobility</td>
</tr>
</tbody>
</table>

### Speculative Diagnosis

Obtaining a clear diagnosis that is consistent with the reported injury is critical for employers in maintaining accurate OSHA records. All providers are encouraged to offer thorough evaluation and provide clear and objective reports. However, decisions that providers make—and the way they phrase their reports—can inadvertently escalate a simple first-aid injury to an OSHA recordable event. That is why employers typically prefer that the evaluating medical provider avoid unsubstantiated diagnosis, such as “rule out fracture” without a clear radiograph confirmation, or dehydration when the symptom is light-headedness. If a definitive diagnosis is uncertain, employers tend to request that the evaluating provider provide a symptom-based diagnosis, such a headache (rather than head contusion), lower-back pain (rather than back strain), and so on. Similarly, noting that an injury “could be infected” or prescribing pain medication “in case it hurts” can change the OSHA recordability status of an injury.
Other Federal Regulatory Agencies

Mine Safety and Health Administration

Beau Braswell, JD

The Mine Safety and Health Administration (MSHA) is also an agency under the U.S. Department of Labor. Similar to OHSA, it develops and enforces safety and health rules for mines regardless of size, number of employees, commodity mined, or method of extraction (such as coalmines, rock quarries, and gravel pits). MSHA also provides technical, educational, and other assistance to mine operators.

MSHA establishes medical surveillance guidelines for mine employees. Historically, miners have been plagued with respiratory diseases (see chapters 2 and 8). Thus, pulmonary exams are an important aspect of screening. For example, coal mine operators must conduct spirometry and chest X-ray examinations with specific reading requirements for all surface and underground coal mine operators. Mine rescue team members must receive initial and annual physicals to ensure that capability to perform emergency rescue and recovery duties; their physicians must sign an MSHA Certificate of Physical Qualification for Mine Rescue Work.

U.S. Coast Guard

The U.S. Coast Guard (USCG) determines medical and physical standards for mariners. Credentialed mariners (Merchant Mariners) must obtain USCG Medical Certification as proof of meeting standards. Physical examination and certification are designed to ensure that mariners:

- are of sound health
- have no physical limitations that would hinder or prevent performance of duties
- are free from any medical conditions that pose a risk of sudden incapacitation, which would affect operating or working on vessels.

Drug and alcohol testing is also an important aspect of the mariner credentialing process, and drug tests are required initially and periodically as well as after certain incidents (such as marine casualties).
Title 49 of the United States Code - Transportation empowers the Federal Aviation Administration (FAA) to regulate and prescribe minimum safety standards for pilots and the aviation industry, including pilot medical certification.

Designated aviation medical examiners (AMEs) perform the vast majority of medical examinations for the approximately 450,000 applicants for pilot medical certificates each year. Approximately 3,500 physicians around the globe are FAA-designated AMEs; they are selected based on geographic need and complete a weeklong training seminar. Ongoing certification requires continuing medical education every three years and compliance with FAA-designated standards for certification and documentation of error rates. Examiners must recognize the responsibility associated with their designation.

**Types of Pilot Certification**

There is no age restriction or aviation experience required for pilot medical certification; however, some minimum age requirements apply for the various pilot license certificates. The three types of certificates are: First Class (airline transport pilot), Second Class (commercial pilot, flight engineer, flight navigator, and air traffic control tower operator), and Third Class (general aviation: private or recreational pilot).

**The BasicMed Rule**

As of 2017, general aviation pilots may operate aircraft with no more than six people onboard (among other restrictions) without holding an FAA medical certificate, as long as they meet certain requirements. Pilots must complete a medical education course, undergo a medical examination by a state-licensed physician—who does not have to be an AME—every four years, and comply with aircraft and operating restrictions. AME designation and examination are considered completely separate from BasicMed.

The BasicMed examining physician must follow an FAA BasicMed comprehensive medical examination checklist, which includes a comprehensive physical examination and review of prescription and nonprescription medication(s) that the applicant reports taking, along with the medication’s potential interference with the safe operation of an aircraft. Providers are required to certify that they are unaware of any medical conditions that, as presently treated, could interfere with the pilot’s ability to safely operate an aircraft.

**Consequences of a Negligent or Wrongful Certification**

The FAA requires that pilots self-report any diagnoses, and under federal law, they are supposed to ground themselves and report any changes in their condition before they can fly again. Primary care providers, whether or not they are AMEs, should be aware that issues of public safety outweigh their individual patient's concern. Even though there is no directive to report disqualifying conditions to the FAA, the primary care physician should not conceal this information.

AME and non-designated physician examiners may bear legal responsibility for failing to find and/or report a disqualifying condition during the course of a thorough examination. In this situation, both the examiner and pilot examinee may be found to have committed a federal
crime—subject to fine and imprisonment.

In the event of litigation related to pilot medical certification, AMEs following FAA guidance generally have protection as well as legal support as FAA designees. Non-AME physicians performing pilot examinations may not have any such protection. It is wise for providers to notify their malpractice carriers that they will be performing pilot BasicMed examinations.
The nuclear industry is heavily regulated, with OSHA, the U.S. Department of Energy (DOE), and the Nuclear Regulatory Commission (NRC) collaborating to protect worker safety and health. The NRC regulates the use of nuclear material by commercial nuclear power plants. The DOE owns, operates, and comprehensively regulates its own nuclear facilities. And, OSHA governs non-radiological health and safety of employees in nuclear power plants and exposure to radiation sources not regulated by the NRC (such as X-ray equipment).

State-Specific Regulations

State and local government workers are not covered by OSHA; however, many states have similar requirements, and some even have more stringent ones. OSHA has approved 28 state plans (26 states, Puerto Rico, and the Virgin Islands). Twenty-two State Plans cover private as well as state and local government workplaces. Six remaining plans cover state and local government only. Generally, State Plans reflect an adoption of federal OSHA regulations. However, states including California, Michigan, Oregon, and Washington have adopted more stringent standards and cover hazards not addressed by federal OSHA.

California, for example, has an OSHA-approved State Plan administered by the California Division of Occupational Safety and Health, more commonly referred to as Cal/OSHA. For approval, California had to adopt a safety and health program at least as effective as the federal OSHA program. California updates its regulations much more frequently and has more stringent requirements. In some parts of the country, local governments, such as counties, parishes, and municipalities, have also established workplace safety and health standards. Thus, it is important for health care providers to consider where employees work and understand local and state regulations.

Disclaimer: This preceding information is meant to provide a brief overview of common laws and regulations affecting worker safety and health requirements in the United States. This list is not comprehensive. Other laws and regulations govern safety and health in the workplace.
CHAPTER SEVEN
PSYCHOLOGICAL FACTORS AND WORKFORCE HEALTH
In the practice of occupational medicine, the patient population consists of workers, and a key measurable outcome is their restoration to full function after an illness or injury. The bureaucratically driven practice of medicine today relies heavily on providers’ ability to explain the causes of injury and the influences on patients’ outcomes as either physiological or psychological. However, scientific evidence endorses cause-and-effect relationships among biology, psychology, and sociology. Much has been written about this “biopsychosocial model” of understanding these interactions. However, the biopsychosocial-economic (BPSE) model broadens the scope further by taking into account the complex, variable interaction of

- biological factors (pathophysiologic, genetic, biochemical, physical, structural)
- psychological factors (mood, emotion, personality, behavior)
- social factors (personal and work relationships, religion, work culture)
- economic factors (income, future earnings, savings, bills, debt)

Application of the BPSE model assists providers in guiding the injured worker through the path to functional recovery.

For purposes of simplicity, in this chapter, the word “injury” is used to encompass both conditions. The term “provider” encompasses physicians, nurse practitioners, physician assistants, chiropractors, psychologists, and other health care providers in a treating role. Injuries that disrupt individuals’ ability to work often become defining points, turning people’s lives upside down. They have to deal with pain, impairments, and dependency on others. They may be upset at someone or themselves for the circumstances that caused the injury. These stressors are exacerbated by the complicated workers’ compensation and disability benefits systems patients are forced to deal with. They worry about how they will support themselves and their families. Their absence from the workplace and alterations in their normal routines can significantly affect their relationships.

Moreover, the decision makers affecting a worker’s fate (employers, insurers, and medical providers) are frequently disconnected from one another and provide inadequate communication to the injured worker, causing delays in treatment and recovery, and increasing the individual’s stress. No two people are the same. An identical injury, identical diagnosis, and identical treatment can have drastically different outcomes in various people’s lives; outcomes cannot be predicted by biological explanations alone. Treatment plans that focus only on physical impairment may not result in a successful return to full function. Application of the BPSE model demands a multidisciplinary treatment program that results in improved functional restoration.

Stress in the Workplace

“Feeling stressed,” or “stressed out” are common expressions of anxiousness. Stress subjectively describes an undesirable emotional tension or an uncomfortable state of mind resulting from an individual’s interpretation of circumstances. These terms are frequently used synonymously with nervousness, or anxiety. Stress can arise from any situation or thought that induces feelings of frustration, anger, nervousness, or anxiousness. However, stressful circumstances are subjective, because what may be stressful to one individual could be enjoyable to another.
At its most basic level, occupational stress is associated with job requirements that do not align with the worker’s capabilities, resources, or needs. But, it also results from much more, including: an unpleasant work culture, role conflicts, unrealistic expectations, excessive or insufficient responsibilities, job insecurity, interpersonal conflicts, inadequate social support, physical stressors, hazardous conditions, and highly automated work processes. Shift work is a significant risk factor for occupational stress-induced psychological conditions as well as non-psychological medical conditions.

Stress is a serious occupational health problem commonly resulting in decreased function and productivity. Low-grade stress can subtly affect a person’s mood and efficiency. It also causes physical and psychological injury and promotes disease. Stress alters the serum levels of multiple hormones including glucocorticoids, catecholamines, growth hormone, and prolactin. Principal effects result from a neurohormonal reaction initiating in the hypothalamus and resulting in adrenal glands releasing epinephrine and cortisol. Epinephrine’s effects include elevated blood pressure and heart rate, pupil dilation, and elevated blood glucose. Cortisol, the principal stress hormone, suppresses the immune system, bone formation, digestive system, and reproductive system, and increases glucogenesis. And yet, the process is not entirely understood: double-blind, placebo-controlled studies have not demonstrated that the direct administration of glucocorticoids affects mood, emotional arousal, or anxiety levels.\(^i\)\(^,\)\(^ii\)

When physical exertion is needed, the effects of these hormones can be beneficial, sharpening the senses, elevating the heart rate, deepening respiration, and tensing muscles. The benefits of occupational stress can be seen on the first day at a new job or when one is working under a deadline. Appropriate mild neurohormonal effects increase energy and heighten concentration. However, after crossing a threshold, they induce myriad undesirable effects, including:

- nervousness
- irritability
- poor concentration
- depression
- fatigue
- fear
- upset stomach or nausea
- dizziness
- confusion
- heightened or lowered alertness
- sweating
- thirst
- headaches
- visual difficulties
- jaw clenching
- nonspecific aches and pains
- feeling overwhelmed and potentially panicked
- excessive alcohol and/or drug consumption
- insomnia
- pacing
- sexual dysfunction
- anger or short temper
- withdrawal
- outbursts
- behavioral expressions may include:
- excessive alcohol and/or drug consumption
- pacing
- sexual dysfunction

Long-term low-grade activation of the stress-neurohormonal response system leads to overexposure of these hormones and stimulatory responses. This increases the risk of a number of chronic health conditions, including those listed above as well as hypertension, weakened immune system, autoimmune disease exacerbations, digestive problems, stomach ulcers, obesity, cardiovascular disease, chronic pain, and suicide.\(^iii\)

Stressful working conditions can interfere with safe work practices and result in increased occupational
injuries. They also prolong injury recovery and functional restoration. The International Labor Organization, in its *Encyclopedia of Occupational Health and Safety*, reports that job stress has become a leading source of worker disability in North America and Europe. Several studies, including those by the National Institute for Occupational Safety and Health (NIOSH) have found strong associations between job stress and delayed functional restoration. Studies have also demonstrated that injuries and work disability are related to psychosocial job factors, frequency of job problems, job dissatisfaction, negative human interactions, organizational deficiencies, patient and clinician expectations, and other factors.

Occupational stress plays a major role in adjustment disorder, major depressive disorder, and generalized anxiety disorder. Situations of extreme stress can result from workplace violence and can cause occupational PTSD.

**Psychosocial Effects on Recovery**

The tremendous inconsistency among injury outcomes under very similar, or even identical, circumstances owes to the complicated variability among individuals, physically, psychologically, socially, and economically—in other words, the components of the BPSE model. Biological factors alone poorly predict the outcome of occupational injury. For example, the average time for an otherwise healthy worker to physically heal from uncomplicated low back pain ranges from a couple days to a few weeks, and return to work can range from zero days to several months, years, or even permanent disability.

In addition to treating the biological injury, the provider using the BPSE model addresses the psychological, social, and economic factors affecting the patient. The first steps include holding a patient-provider discussion of these issues, educating the worker about the approach, and setting appropriate expectations. This process may include referrals to other specialists and close follow up.

Providers play a crucial role in their patients’ functional recovery. Providers who understand the complex intersection of biological and nonbiological factors and spend the time required to construct a comprehensive treatment plan with their patients see improved outcomes of functional restoration.

**Reducing Workers’ Stressors Outside of the Workplace**

Sometimes, occupational stressors are inevitable, and de-stressing is up to the worker. The provider should educate and support his or her patients about making lifestyle modifications—a process that takes time. Treating stress starts with diet, exercise, and sleep. The healthy diet emphasizes whole vegetables, fruits, complex whole grains, and lean meats and limiting fast or processed foods, alcohol, and overeating. Good sleep cannot be emphasized enough: providers can teach their patients good sleep hygiene, educating them about restorative sleep and explaining that sleep affects their mental and spiritual well-being. Aerobic exercise such as jogging or bicycling, yoga; deep breathing; meditation; and massage all reduce stress. Providers can inspire patients to engage in relaxing hobbies such as music and reading, and remind them of the benefits of healthy intimate relationships, emphasizing in-person versus internet contact. In addition, cultivating a good sense of humor, participating in community volunteer activities, decreasing commitments, and, if possible, working from home all decrease stress.

**Reducing Stressors in the Workplace**

Declining productivity of an individual or organization should prompt a search for stressors. Providers can impact populations when exerting influence at the organizational level. In the best case, they
develop relationships of trust with industry leaders and convince them that organizational success results from improving the healthy work environment. Providers should educate the decision makers that there are proven associations between occupational stress and injuries, work absence, and hence, productivity losses. However, as discussed, work absence due to delayed functional recovery is the result of multifactorial elements and can be difficult to control. Regardless, efforts to mitigate workplace stress that reduce “presenteeism” (being present but not fully functional) result in increased productivity.

**Workplace Violence and Occupational Posttraumatic Stress Disorder**

Workplace violence is a major source of occupational stress and is now a common cause of posttraumatic stress disorder (PTSD). Such violence can include any act or threat against a person or property that occurs within the confines of the workplace or related to the workplace environment. It includes threats, intimidation, disrespect, insults, coercion, frightening, harassment, stalking, assaults, homicide, or any unacceptable disruptive behavior that results in fear for personal safety. On the more severe end of the spectrum, stress caused by violence can have an impact on vital signs, cause a panic attack, or cause psychiatric disease. Less severe forms of violence—such as an intimidating boss publicly insulting his or her employees—can cause subtle stress and often goes undetectable.

Workplace violence can be inflicted by an employee, manager, supervisor, coworker, customer, patient, relative, domestic partner, personal acquaintance, or stranger. A large variety of circumstances in the work environment are associated with workplace violence. Some examples include disciplinary actions, job loss, abusive authority, and interpersonal conflict. Workplace violence can also be a product of bigotry and extremism, which can lead to hate crimes and terrorism. Workers who are at higher risk for experiencing workplace violence include convenience store employees, taxi drivers, bus drivers, health care workers, law enforcement personnel, military personnel, security guards, bartenders, sales employees, and teachers.

**Preventing Violence Is the Goal**

Workplace violence can and does happen anywhere, although certain workplaces are at higher-than-average risk for coworker violence: their characteristics include job insecurity, perceived injustice, and a harsh management style. Prevention starts with instilling a climate of safety and communication transparency, with top leadership setting the tone. Employees’ reports must not lead to retaliative action against the reporter. Policies and procedures must serve as the legal backbone for enforcing disciplinary actions, and employees should be well aware of policies regarding harassment, intimidation, violent threats, and violence. Employees should also know how to identify warning behaviors, take them seriously, and to whom they should be reported. Prevention controls that employers may use include video surveillance, alarm systems, metal detectors, lighting, physical barriers, secured access, panic buttons, accessible exits, and security staffing.

As with any occupational hazard, the first goal should be to prevent violence from occurring. As in any other workplace injury–mitigation program, a hierarchy of hazard controls should be applied through the hierarchy of elimination, substitution, engineering controls, administrative controls, and lastly personal protective equipment.

Violence between coworkers is often preventable because it is usually preceded by multiple warning signs. They include:
- direct or indirect threats
- mood or behavior changes
- controlling behaviors
- paranoia
- weapon possession/acquisition
- stalking
- taking extreme positions on beliefs
- fixation
- financial hardship
- loss of an intimate relationship
- isolation
- anger outbursts
- absenteeism
- presenteeism
- similar extraordinary behaviors.

It is important for all parties involved to identify these circumstances early and take appropriate mitigative actions, such as approaching the coworker, notifying the police, or bringing these concerns to the attention of supervisors. When providers get involved, they play an intimate role in preventing workplace violence by picking up on clues during patient interviews and exams.

To screen persons at high risk for acts of violence, providers can ask probing questions regarding social history, mental health, stress, and relationships. Depending on the circumstances and purposes of the patient encounter, the following questions can be used:

- When was the last time you used an illegal controlled substance?
- Have you ever been in police custody or arrested or charged with a crime?
- Have you ever thought of harming yourself?
- Have you ever resorted to physical violence or verbal abuse to resolve a conflict?
- In the past year have you experienced an extreme change in your beliefs?
- How do you deal with people whose beliefs are contrary to yours?
- Do you have any strong beliefs that could justify violence?
- How does it make you feel when people tell you what to do?
- What is the worst bullying or humiliation that you ever had to endure?
- Do you have any debt collectors calling you?
- Have you ever been the subject of a restraining order?

If a provider suspects an imminent act of violence, the provider should consider his or her plan, which can include notifying the appropriate authorities, consulting with legal counsel, and convening a committee or task force with the employer.

When screening for potential violence, providers should always be alert to indicators that the interviewee is lying, usually detectable through a change in baseline behavioral and communication patterns. Deception indicators include increases in leg movements or fidgeting, pupil dilation, staring at the provider, and speech abnormalities.

The most effective method for detecting deception in an interview may be through subjecting the
interviewee to cognitive overload. Asking a series of questions that do not require much effort to answer, in quick succession, will cause a deceptive person to have to slow down to calculate responses.

The following reactions are fairly reliable signs of deception:

- Repeating the question, delaying, or using other stalling techniques such as saying “that’s a good question”
- Asking for the question to be repeated
- Redirecting to another topic

When providers are part of a committee dedicated to addressing threats in the workplace, they serve as the behavioral experts trained to identify and assess aberrant behaviors and can advise management, human resources, legal, and/or insurance professionals to assess a worker’s changing behavior.

The Provider’s Role After an Incident

After a workplace violence incident has occurred, early interventions can significantly expedite the victim’s physical and emotional recovery and decrease his or her risk for chronic physical and psychological conditions. Assuring timely help and support may prevent normal stress reactions from worsening and developing into PTSD. A post-incident plan is a vital component to an effective violence-prevention program. All workplaces should have and use violence incident report forms; NIOSH and OSHA provide free online examples. The plan should include immediate notification to a supervisor or management, who should refer the employee to the employee assistance program if the workplace offers one. Coordinated services for counseling, legal advice, medical treatment, and thorough information about workers’ compensation should be provided. Medical professionals should be made easily accessible, free of charge, to all those involved, victims and witnesses alike.

The victims of violence can suffer from short- and long-term mental health conditions, fear of returning to work, changes in their relationships at work and at home, feelings of guilt, and fear of backlash from supervisors. In addition to the provider, professionals who can provide care include certified employee assistance professionals, psychologists, psychiatrists, clinical nurse specialists, and licensed clinical social workers. In addition to rendering appropriate treatment, providers should also identify the cause of the incident in order to make recommendations to the workplace to prevent a similar event from occurring in the future.

PTSD

Most workers who experience workplace violence or other forms of trauma experience only temporary difficulties with coping and dysfunction. PTSD screening should include psychological/psychiatric evaluation and psychometric testing. When symptoms worsen, last longer than one month, and are accompanied by functional impairment, the worker may have occupational PTSD. Common signs and symptoms of PTSD include intrusive recollections, disturbing dreams, hypervigilance, startle responses, difficulty sleeping, avoidance of external reminders of trauma, persistent and exaggerated negative beliefs and emotions, and social withdrawal.

Diagnostic criteria for PTSD include symptoms that create distress or functional impairment that are not due to medication, substance use, or other illness, and all of the following must be present for more than one month: at least one re-experiencing symptom, at least one avoidance symptom, at least two
arousal and reactivity symptoms, and at least two cognition and mood symptoms. Acute stress disorder is a condition which meets the same criteria as Post Traumatic Stress Disorder, but has been of less than 30 days duration. Treatment plans may include education, exercise, yoga, cognitive behavioral therapy, mind/body interventions, deep breathing exercises, meditation, exposure therapy, virtual reality, and medications. Providers should consider early referral for a mental/behavioral health evaluation.

Risk factors for developing PTSD include prior psychiatric disorder, prior trauma exposure, genetic predisposition, history of chronic stress, personality factors, low IQ, and history of substance misuse. Women are also at greater risk than men of developing PTSD.

PTSD has become a major health and safety issue over recent years. Individuals with occupations that are at higher risk of workplace violence than others are also at higher risk of developing PTSD. They specifically include law enforcement officers, military personnel, security guards, bartenders, professional drivers, gas station attendants, nurses, and managers of food service and lodging establishments. PTSD diagnoses are increasing in the U.S. population, and they are increasingly being attributed to workplace trauma in which the worker was the victim of or witnessed the severe traumatizing event. Such exposures can include but are not limited to life-threatening events, homicide, suicide, death, hostage events, terrorist attacks, assault, sexual assault, battery, and natural or man-made disasters.

Returning to Work After Injury

Human beings have an intuitive desire for human-to-human relationships; hence the formation of societies. Societies are built on the idea that individuals contribute to the betterment of the group and the society benefits the individual. In general, working—whether it produces income or not (such as family child rearing or elder care)—is the way individuals contribute to society. Working is good for health and well-being and has an overall positive effect on mood, self-esteem, and identity. It builds confidence and provides financial stability. Unemployment has been associated with increased psychiatric hospitalizations and suicide rates. Sustaining the worker’s functional health encourages continuing contributions to society, which in turn decreases the costs of disability programs and promotes a more prosperous society.

People identify themselves to a great extent by their occupations. Excelling in one’s occupation provides significant meaning to life. Similarly, our personal intimate relationships also form an important part of self-identity and give our lives meaning. That is why when a therapist counsels a patient who is undergoing marital stress, divorce is not usually discussed as the first step. However, when a patient describes work stress, leaving work is often seen as the solution instead of attempting conflict resolution and preservation of relationships. Although providers understand the need to protect and foster role-functioning in personal relationships, the similar importance of role-functioning at work is often overlooked.

Movement: The Best Prescription for Recovery

Over the past few decades, scientific studies have continued to demonstrate that the historical model of “rest” as a treatment for injury, is frequently not the right answer and in fact can worsen the injury and/or delay recovery. This is reflected in the recent conversion of the traditional treatment advice from “RICE” (rest, ice, compression, and elevation) to “MICE,” where the “R” for “rest” was replaced with “M.”
for “mobilization” or “motion.” This advice applies to both injury and surgical recovery.

Many chronic medical conditions are effectively treated with physical activity. Examples include chronic pain, fatigue, and fibromyalgia. Remaining at work or returning early to some form of productive labor improves clinical outcomes compared to passive medical rehabilitation. Therefore, activity prescriptions such as exercise, active self-care, and the earliest possible safe return to work should be included in all treatment plans.

Discouragingly, some providers continue to prescribe rest, inactivity, being off work, and passive rehabilitation treatment plans that promote continued negative outcomes. These inappropriate prescription practices commonly occur when providers succumb to patients’ demands as opposed to rendering care consistent with evidence-based guidelines.

Unnecessary prolonged absence from work can cause needless and significant harm to workers’ well-being. A prolonged absence from work is likely to cause their self-identity to shift from that of a functioning worker to that of a sick, injured, or even disabled person. The worker disconnects from social relationships with coworkers, which jeopardizes his or her self-esteem and unnecessarily reduces quality of life. The “injured worker” label excuses his or her absence from normal responsibilities and too often inspires a victim mentality. This role enables people to receive help from others instead of helping others. Functional recovery and return to work are needlessly delayed, sometimes resulting in preventable permanent total disability. To recover, the worker needs to redefine him or herself as a productive worker.

Avoiding Delayed Recovery

Every day, workers decide whether to stay at home or go to work. When a worker has a cough, backache or headache, he or she has to decide whether to call in sick, request modified work or hours, or “tough it out.” In making this decision, the worker considers his or her functional impairments and limitations, as well as the psychosocial and economic effects of working while injured versus missing work. The first encounter with a provider can be the difference between the worker’s rapid recovery and permanent disability.

The U.S. military long ago discovered that when service members with relatively simple physical injuries were left to recover without medical supervision or received inappropriate treatment for low-grade deployment-related stress, some would become permanently and totally disabled. Under the circumstances of combat stress, the innate human protective psyche is often depleted and what were initially simple, repairable injuries were transformed into socially acceptable and serious disabilities. Once the military labeled a service member disabled, he or she was released from duty. In response to these circumstances, the U.S. military evolved a treatment model, referred to as the S.P.I.C.E. model to promote their members’ full physical and emotional recovery (see Chapter 2, Musculoskeletal Injuries). The model emphasizes making timely and simple diagnoses and treatment plans that fuel patients’ healthy identities and expectations of a speedy and full return to work.

Multiple key decision makers are involved in the process of keeping an injured worker at work or helping him or her return from an injury related absence. The employer decides whether modified work duties or hours are available; the physician determines the treatment plan and when to prescribe activities; the claim administrator decides on compensation benefits; and the worker ultimately has the final say. Often, these decision makers are not aware of the harmful effects of prolonged work absence and
unknowingly contribute to a downward spiral of system-induced loss of function and disability. Several studies have confirmed that the likelihood of returning to work decreases with each day off work. Prevention is key, and all decision-makers’ efforts should apply the BPSE model and be focused on early, thorough, and timely response to occupational injuries to achieve the earliest return to function as possible.

**The Role of Workers’ Compensation in Recovery and Return to Work**

Delays in recovery can be due not only to the complex interactions described by the BPSE model but to administrative issues as well. Examples include delays in specialty referral and care, lack of available modified work, inefficient communication, and ineffectual leadership. The worker’s recovery is heavily influenced by his or her interactions with the work environment, medical provider, and the workers’ compensation system, as well as the interactions among these components. Workers’ compensation plays a large role, because it is responsible for authorizations and payments for injury claims, medical treatment, and rehabilitation. Multiple parties may be involved in a worker’s claims: case managers, benefits administrators, insurance carriers, supervisors, human resources staff, medical providers, lawyers, union representatives, and often the employee’s families.

Although workers’ compensation programs vary from state to state, all provide basic benefits to the employee who is out of work because of a work-related injury. Temporary disability benefits cover lost wages during recovery; permanent disability covers a lasting disability, resulting in a reduced earning capacity after maximum medical improvement is reached. However, most worker’s compensation systems treat mental and behavioral conditions different from medical conditions with less coverage or other limitations.

Logistical hurdles, such as a delay in authorization of surgical repair, are common in the workers’ compensation system and can directly and indirectly impact workers’ recovery and return to work. Studies confirm that the workers’ compensation system is confusing and administratively taxing to both providers and injured workers. Delays in the submission of records to workers’ compensation officials can be viewed as “non-cooperation” by the patient, which in turn can result in decreased or even terminated reimbursements. Additionally, though workers’ compensation adjusters prefer black and white opinions from providers regarding causation, it is often difficult to make a clear determination. These factors can result in incomplete and/or incorrect communications among parties and lead to more complications for workers’ recovery.

A systematic literature review found that the vast majority of the interactions workers have with workers’ compensation insurers are negative at every stage of the claims process, from delays that occurred in the initial claim to prolonged disputes over the claim settlement. It also found that the injured workers’ interaction with insurers caused significant psychosocial consequences, and some of these effects remained long after claims were settled.

Although many employers, employees, and intermediaries work out disability claims in a mutually acceptable manner, opposing interests are what lead to legal involvement. Employees can be dishonest—creating fictitious injury claims or exaggerating the symptoms of a legitimate injury. Supervisors and management may unjustly influence workers not to report injuries—or may have failed to correct the dangerous working environment that caused the problem. Workers’ compensation insurance administrators may be subjected to pressure from management to deny claims, and benefit administrators may request that medical providers elicit language from patients that can be used to
their advantage. Moreover, providers may be incentivized to inappropriately medically manage the patient to support the position of the organization, insurance company, or patient. Although these parties may have different incentives, ultimately they are all influenced by financial gain.

Many injured workers hire legal counsel out of frustration with the claim process. There are benefits and disadvantages to legal assistance. Often it prolongs the resolution of contested decisions, and in circumstances where medical care is pending payment authorization, the delays can increase the suffering of the injured worker. The legal system tends to draw out the recovery process because the worker is forced to rehearse and relive the injury events and the symptoms of the injury. The longer the worker remains out of work, the greater the likelihood of poor functional outcomes. This process can result in the artificial and unnecessary creation of a worker’s newfound identity as a disabled person. Still, there are circumstances in which injured workers have no other recourse than to turn to legal counsel to be granted the benefits to which they are entitled.

Managing Difficult Cases

Injured workers may present themselves to the provider for reasons that are difficult to determine and that sometimes may not even be entirely understood by the patient—especially in the event of “system-induced disability,”—that is, disability that could be avoided with appropriate and timely treatment. There may be both a conscious and/or unconscious awareness of their intentions for secondary gain. Providers inevitably have to confront workers who try to game the system. Hidden agendas can lead to incorrect diagnoses, workups, treatments, and otherwise avoidable poor outcomes. They may be seeking a particular diagnosis or treatment pathway to obtain or maximize disability benefits.

Several factors can complicate the provider’s approach to a potentially unscrupulous patient. First, it can be time-consuming to untangle a patient’s history, and a provider may want to avoid offending the patient. Moreover, it takes time to understand the many complicated disability benefit plans, and how providers’ actions can affect the worker’s future.

But providers should be careful when making medical decisions if the data reported by the injured worker significantly deviate from the objective findings or if symptoms are vague or over-dramatized. Ideally, providers can attempt to unsheathe ulterior motives and address them with the patient. For example, the worker’s ongoing harassment by his or her supervisor could be the cause of chronic back pain. Alternatively, this same person could have sustained a back injury in a car accident, resulting in severely herniated discs, but is alleging an occupational injury to obtain disability benefits. The provider-patient relationship is built on trust, and a provider’s initial tendency to believe the patient.

The provider’s approach to the injured worker whose recovery is delayed beyond reasonable expectations should be hands-on, with frequent follow-up, clear communication, and well-defined expectations. The provider should frequently and openly communicate with the involved parties, including the employers’ human resources staff and insurers. The provider should frequently and appropriately prescribe advancing activities. Applying the BPSE model to these cases will alleviate frustrations and end in more successful and timely functional restoration.

Diagnostics and treatment plans should follow objective evidence-based medicine. ACOEM Practice Guidelines are the gold standard in effective treatment of occupational injuries and illnesses and are available at MDGuidelines.com®, a web-based resource that is updated with ACOEM’s evidence-based methodology that incorporates physiologically based disability duration tables that assist with managing
return-to-activity expectations. These guidelines can help the provider determine whether to order a specific diagnostic test, which therapy and treatments to use, or when an injured worker may be able to return to full duty.

Return to work should always be part of the treatment plan, whether it is modified or full duty. At every visit this aim should be discussed and planned with the injured worker. The provider’s mindset should not be “functional recovery to be able to return to work,” but “return to work to achieve functional recovery.” When employers do not have any modified work available, providers should take even greater steps to ensure that the worker’s time spent away from work is mentally and physically productive. Consider prescribing more physical therapy, yoga, tai chi, meditation, walking, swimming, and any other forms of physical activity. Remember that movement is improvement and keep in mind that the purpose of treatment is to improve function; if there is no improvement in function, consider alternative evidence-based treatments. Providers who apply the BPSE model will have greater success in restoring function.


CHAPTER EIGHT:
INDUSTRY-SPECIFIC PEARLS
Agriculture—comprising production, promotion, and distribution of agricultural products—is one of the most dangerous occupations in the United States and around the world. It is also a critical industry in rural United States, accounting for 2.06 million farms and supporting 18.7 million jobs both directly and indirectly through food-related jobs. Because it is such a diverse industry, the agricultural workforce is subject to widely varying occupational and environmental exposures. One unique feature is the number of youth under age 20, and even under 16, involved in potentially hazardous work. The health conditions workers acquire include increased prevalence of respiratory disorders, arthritis, hearing loss, skin cancer, and musculoskeletal disorders.

Recognizing Agricultural Occupational Issues

It is difficult for a health care practitioner to be an expert in all agricultural occupational injuries and illnesses, but the following sections lay out the primary conditions. A basic starting point is obtaining an occupational health history relevant to agriculture. Besides asking whether a patient farms, primary care providers should ask specific questions about the type of farming the worker does, the equipment he or she uses, and what type of (and when) personal protective equipment (PPE) is used. Health care providers can strongly contribute to prevention by asking their patients about their use of PPE, making safety brochures available, and suggesting safety practices. They should also inform themselves about the high-risk practices in the worker’s service area; land-grant university extension services, the National Institute for Occupational Safety and Health (NIOSH) agricultural health and safety centers, and occupational medicine residencies all provide this type of information.

Injuries and Safety

Farming has consistently ranked among the top three most hazardous occupations in the United States. Moreover, the Occupational Safety and Health Administration (OSHA) does not regulate small farms of 10 or fewer employees, which make up the majority of farms and the farm labor population. Dangerous exposures stem from operating dangerous machinery, animal handling, working in extremes of temperature, and working in isolated conditions where emergency care is not readily available.

Respiratory hazards include exposure to toxic chemicals from pesticides and agricultural gases as well as organic dust, causing respiratory inflammation. Physical hazards include suffocation in grain storage bins and other confined spaces, electrocution, and constant solar exposure. Loud-noise exposure is also common, and hearing loss is frequent.

Ergonomic hazards from frequent lifting, bending, stooping, and handling irregularly shaped commodities are a common source of musculoskeletal injuries. Tractor rollovers are a significant cause of fatalities resulting from the continued use of pre-1976 tractors without rollover protective structures (ROPS) or seatbelts. NIOSH estimates that almost all tractor-related fatalities could be prevented by uniformly retrofitting older tractors with rollover protection and by users wearing seat belts.
Workers’ compensation programs are state based, and perhaps no industry features as many state-by-state variations as agriculture does. Providers should be aware of any potential agricultural labor exemptions from workers’ compensation laws that apply to their states, such as a lack of coverage for family members or part-time workers. Farm labor contractors rather than the farm owner are often responsible for providing work-related injury treatment for seasonal and migrant workers. Other obstacles facing agricultural workers are finding physicians and clinics available and willing to handle workers’ compensation injuries and a lack of occupational medicine specialists in rural areas.

**Ergonomics and Musculoskeletal Injuries**

Musculoskeletal injury–related ergonomic issues, including sprains and strains, are common. Agricultural work involves heavy lifting, much repetition, awkward positions, and bent wrists. There has been an evolution over the last 15 to 20 years from back and knee injuries in smaller dairies to upper-extremity injuries in high-production dairies. The growth of large dairy parlors and the need to milk hundreds of cows daily involves repetitive reach and grasp, resulting in hand-shoulder syndromes, wrist and hand tendonitis, and carpal tunnel syndrome. Production in farms with several thousand hogs is associated with wrist symptoms and back pain. Small vegetable, fruit, and nut production is associated with stoop- and-squat work, resulting in low-back, neck, and knee disorders.

Implementing corrective ergonomic interventions in farming is difficult because the objects being handled are so varied. Ongoing research in university agricultural engineering departments has produced tools to improve work positions and body posture: Modifications include handles on fruit tubs, adjustable floors in dairy parlors, portable stools to avoid squat and stoop, and improved straps on fruit-collection bags.

**Respiratory Disease**

Workers in small and large-scale farms are at risk from dust inhalation, which leads to respiratory inflammation if proper ventilation and PPE are not appropriately used. Organic dusts are generated by both animal and crop production. Grain dust is biologically active, composed of particulate matter, animal dander, feces, antibiotics, pesticide residue and other agricultural chemicals, bacteria, and fungus. Hog production in particular is associated with chronic bronchitis, mucous membrane irritation, and chronic sinusitis resulting from the inflammatory effects of organic dust. Occupational asthma is much less common, although preexisting asthma can be aggravated by organic dust. Dairy farms are more commonly associated with organic dust toxic syndrome (ODTS) and farmer’s hypersensitivity pneumonitis (FHP), commonly known as farmer’s lung.

Various agricultural exposures can have overlapping clinical presentations of a viral–like syndrome, requiring a good clinical history and differential diagnosis. For example, the clinical presentations of both ODTS and FHP are identical to viral symptoms with shortness of breath and a delayed onset of 4 to 6 hours after exposure. ODTS is a non-immunologic inflammatory response that results from a one-time massive exposure to organic dust; whereas, FHP is a complex immune-mediated inflammatory response resulting in sensitization to organic dust. Eventually, recurrent FHP symptoms and permanent lung damage occur with repeated exposure to lower levels of dust. Properly using personal respirators; increasing ventilation; and drying feed, hay, and grain before storage to decrease bacterial and fungal overgrowth growth can prevent both conditions from
 occurring. Primary care providers play an important role in discussing the use of appropriate respirators for the type of exposure and conditions and helping patients use them effectively.

Agricultural gases can also cause long-term health effects and death. Hydrogen sulfide is generated by bacterial decomposition of manure and can be lethal in a matter of seconds when agitated or disturbed. Exposure can cause an immediate loss of consciousness called “knock-down” at concentrations above 500 ppm by a mechanism similar to cyanide poisoning. Entering recently filled silos too early can result in toxic exposures to nitrogen oxides, leading to silo-filler’s disease. High concentrations can lead to respiratory distress and loss of consciousness. If the person survives, interstitial fibrosis and scarring can lead to permanent lung damage, called bronchiolitis obliterans. Knowledge of safe entry times and use of gas meters to identify lethal concentrations of gases are critical to decreasing serious injuries and death. Well-run larger operations with designated safety managers should provide training to farm workers about these conditions, but smaller family farms do not always implement this type of training program.

**Pesticide Exposures**

Pesticides are a critical component of modern agriculture worldwide, even with the increased production of and consumer demand for organic food. Only pesticide applicators licensed by the Environmental Protection Agency (EPA) may purchase and apply restricted pesticides. These users may include commercial pesticide applicators, farm owners, or employees who have become licensed. The primary categories of pesticides include organophosphates (OPs), carbamates, pyrethrins and pyrethroids, herbicides, fumigants, fungicides, organochlorines, disinfectants, and rodenticides.

Insecticides primarily include OPs, carbamates, pyrethrins, and organochlorines.

For humans, the most acutely hazardous pesticides are OPs and fumigants. OPs are unique as the only class of pesticides that has a specific antidote: pralidoxime (2-PAM) to prevent irreversible binding. OP poisoning is recognized by the muscarinic symptoms, which require treatment with massive doses of atropine in addition to pralidoxime. The other pesticide poisonings require nonspecific life-support stabilization and, potentially, hemodialysis. Rescuers and health care providers must avoid contaminating themselves by wearing proper PPE while treating and decontaminating victims.

Contaminated clothing must be treated as hazardous waste. In every state, 1-800-222-1222 is the poison control number and a source of critical information for health care providers treating pesticide poisoning. OPs are also unique among pesticides in that there are specific blood tests, plasma and red blood cell cholinesterase, used to diagnose poisoning and monitor chronic exposure.

**Resources**

The EPA’s publication *The Recognition and Management of Pesticide Poisonings, 6th Edition* is a free online resource for health care providers. The 11 NIOSH regional Agricultural Health and Safety Centers are additional sources of information about agricultural health. The AgriSafe Network and Migrant Clinician’s Network are nonprofit organizations that educate health care providers and also can be valuable sources of information. Land-grant university extension departments can be
another source of written material about agricultural hazards and preventive measures.

References

In the early 1900s, coal mine deaths in the United States exceeded 2,000 annually. In 1907, 362 miners were killed in the worst single coal mine disaster in U.S. history—an explosion at the Monongah Mines in West Virginia. As is typically the case, large-scale disasters were the impetus for legislative change, and in 1910, Congress established the Bureau of Mines under the Department of the Interior with the goal of conducting research and reducing accidents in the coal mining industry.

The industry’s unique federal oversight is relevant to the issue of mining-specific diseases and accidents. Although the primary care provider need not know the nuances of mining laws and regulations, it is important to have some background, because it can play into everyday medical care.

The mining industry is not governed by OSHA, but by a separate federal regulatory body, the Mine Safety and Health Administration (MSHA). OSHA and the National Institute for Occupational Safety and Health (NIOSH) were created in 1970. NIOSH was established as part of the Centers for Disease Control within the U.S. Department of Health and Human Services to ensure safe working conditions. OSHA was established under the Department of Labor (DOL) as the federal authority responsible for prescribing and enforcing regulations affecting occupational health or safety. Both OSHA and MSHA are managed by the DOL, which specifies that when “the provisions of the Mine Act either do not cover or do not otherwise apply ... then the OSHAct will be applied to those working conditions.” Therefore, although the two statutes differ and employer reporting differs, treatment by the provider is basically unchanged regardless of the federal entity overseeing the industry. Interestingly, whereas NIOSH merely advises OSHA on its standards, it actually develops the health standards for MSHA to prevent occupational disorders.

**Mining-Related Disorders**

Occupational disorders seen in miners include respiratory diseases, traumatic and repetitive or cumulative musculoskeletal injuries, and noise-induced hearing loss (NIHL). A few of these disorders are specific to the mining industry, but the majority are also seen in numerous occupational and non-work settings. Pulmonary ailments tend to be more mining-specific because they are often caused by inhalation of occupational dust such as coal, silica, and asbestos as well as diesel particulates and welding fumes.

**Coal Workers’ Pneumoconiosis**

The classic and quintessential occupational disease associated with mining is coal workers’ pneumoconiosis (CWP). Pneumoconiosis is an alteration of pulmonary structure from dust inhalation (usually coal, silica, or asbestos) that is non-neoplastic and non-asthma, emphysema, or bronchitis in classification.

CWP, also known as “black lung,” is caused by coal dust, which is primarily made up of carbon. One-to two-millimeter macrophage-laden macules deposit in the alveolar ducts and cause cough and phlegm production. These deposits can result in a reduction in the first second of the Forced
Expiratory Volume (FEV₁) on spirometry and can be seen on chest X-rays. CWP can sometimes progress rapidly from minor simple pneumoconiosis to advanced pneumoconiosis disease with severe reduction in pulmonary function and expiratory flow.

Although CWP is not always aggressive, it can progress very rapidly and without much warning. NIOSH therefore, in 1974, created a radiology “B reader” initiative as part of its Coal Workers’ X-ray Surveillance Program. The B stands for black lung. The program was meant to eliminate inter-reader variability when interpreting chest X-ray abnormalities caused by prolonged dust inhalation. At this writing, there are just under 200 NIOSH-certified B reader radiologists in the United States. Although B readers document chest X-ray findings on all pneumoconiosis cases, it was the need to follow the progression of CWP that prompted the initiative.

B reader findings describe parenchymal abnormalities as well as pleural changes in a systemic and reproducible manner. Chest X-ray findings are described as p, q, or r if they are small, rounded opacities and s, t, or u if small and irregular. Concentrations of these opacities are also documented on a 0/- to 3/+ 12-point scale. Lung zones as well as large opacities, referred to as categories A, B, or C, are also recorded. This NIOSH-sponsored United Nations International Labour Organization (ILO) classification produces standardized and reproducible chest X-ray pneumoconiosis documentation, which aids in individual patient screening and surveillance as well as epidemiology and research.

Apart from CWP, although often confused with it, is a pneumoconiosis caused by silica. Silica is silicon dioxide, and along with oxygen it is the most abundant element in the earth’s crust. It comes in various forms, but crystalline silica—of which quartz is the most common type—is ideal for industrial use because of its very high melting point, hardness, and chemically inert property. Nearly every type of rock contains quartz and thus silicosis is the most common type of pneumoconiosis worldwide. Silicosis caused by the inhalation of crystalline silica dust is non-reversible and progresses in a predictable fashion based on the intensity and duration of exposure. Although there is a likely 10- to 20-year latency period, silicosis can progress even when the worker is no longer exposed. This is important because it can progress while a patient is retired or no longer working as a miner, and thus the work history may be missed. Progression is slow because the dust is toxic to macrophages, and therefore it takes years for bronchiolar clearance of silica to occur.

**Silicosis**

Inhalation of crystalline silica causes an intense cellular reaction and production of “silicotic nodules” of various sizes that form granulomas in the upper- and mid-lung zones. These grow and conglomerate over time, especially if exposure continues, and thus progress from “simple silicosis” to what is known as PMF: progressive massive fibrosis. PMF is also known as “conglomerate silicosis” and can have a butterfly-like appearance several centimeters wide on X-ray. Prior to conglomeration, simple silicosis rarely produces impaired pulmonary function. However, once conglomeration occurs, pulmonary function deterioration is common and can be rapid from then on.

Recurrent bacterial infections, respiratory failure with cor pulmonale, and an increased risk of lung cancer are associated with PMF. There is also a strong association with tuberculosis and a stronger association in rheumatoid arthritis patients who can develop necrobiotic nodules (Caplan’s syndrome). It is therefore wise to obtain a rheumatoid factor and to have a high suspicion for potential concurrent TB.
The main clinical difference of which the physician must be aware between silicosis and CWP is that the latter can be much more rapidly aggressive, whereas silicosis is more common but progresses in a steadier fashion over the years. In 2017, OSHA published new regulations—based on updated data on complications from silica dust exposure—that streamline silicosis-prevention standards across all industries. The new regulations include two respirable crystalline silica standards—one for construction and the other for general industry and maritime. They also mandate exposure-control measures and other requirements such as worker training and medical exams, with chest X-rays and lung function tests every three years, for anyone required to wear a respirator due to silica exposure for more than 30 days a year. OSHA estimates that the new rules will save nearly 700 lives and prevent 1,600 new cases of silicosis per year.

Pneumoconioses are the quintessential mining associated group of diseases; however, miners are affected by other pulmonary disorders as well.

**Other Mining-Related Disorders**

Major improvements in dust control through practical engineering means have resulted in a significant decline in all miner-associated respiratory diseases, especially in the last four decades. Still, mining remains a dangerous occupation. Until 2002, it was listed under the U.S. Bureau of Labor Statistics as the most dangerous industry (now surpassed by commercial fishing and roofing). Beyond producing poor air quality, mine drilling and haulage employ diesel-powered equipment that produces diesel particulate. When inhaled, these diesel particulates (IARC Group 2A) have been linked to an increased risk of lung cancer.

Besides facing the risk of pulmonary disorders, miners are susceptible to the obvious dangers of such a physically demanding profession. Potentially fatal and permanently disabling physical hazards arise from moving machinery, falls from height, flooding, explosions, rock falls, bulkhead collapses, and fires. Less easily identified occupational hazards occur from cumulative trauma. It is important to associate these other, perhaps more subtle, injuries to their occupational origins to ensure that individuals can be cared for under workers’ compensation programs. Workers’ compensation allows health care to be provided to people who would not otherwise have access to care and enables them to maintain a percentage of their income while undergoing treatment and recovery. It also allows for better overall reporting of industrial risks for future engineering and prevention programs.

**Musculoskeletal Injuries.** Miners are especially prone to back injuries resulting from heavy lifting and shoveling, along with slips and falls. Among other causes, the latter can result from an uneven ground environment, which also produces ankle and knee injuries. Overhead work is common in underground tunnels, resulting in rotator cuff and other shoulder injuries. Repetitive upper-extremity motions can also result in lateral and medial epicondylitis and carpal tunnel syndrome. Use of heavy mobile equipment such as rock drills can also produce hand-arm vibration syndromes and repetitive whole-body vibration. This physical stress can further exacerbate musculoskeletal ailments, especially spinal disorders. Despite the mechanical automation of many mining operations, the industry continues to remains heavily dependent on physically demanding manual labor.
Isolation and Shiftwork: Besides addressing the industry-specific and common occupational pathology that providers encounter, the health care worker also has to remember that miners frequently work in isolated environments that operate 24 hours a day. The resulting shiftwork provokes a unique range of occupational maladies, from fatigue to severe regular sleep deprivation and accompanying cognitive and motor impairments. Such an environment also lends itself to unhealthy dietary intake and other social stressors. Underground mines obviously do not have cell phone or wireless reception, and miners are often closed off from family members and events aboveground during their shifts. Such closed communities can be prone to significant psychological stressors whenever an injury occurs and can lead to increased drug and alcohol use as well as posttraumatic stress disorder.

Skin Disorders: In deep underground mines, Miliaria rubra (“mucker’s mange”) is a prevalent skin disorder due to the hot environment, low ventilation, and perspiration, all exacerbated by the miner’s clothing and personal protective equipment. The condition, which frequently occurs in overheated patients, is also known as heat rash or “prickly heat,” as the occlusion of eccrine sweat ducts results in papules and vesicles that patients describe as stinging instead of itching. It is generally self-limiting, but treatment involves moving the patient to a cooler environment and applying desonide or other anti-inflammatory lotion. Most patients adapt over time, but some do not and are not well suited for work in a hot underground mine.

Noise-Induced Hearing Loss: The proximity of heavy machinery exposes the mining-industry worker to a substantial amount of unwanted noise and resultant noise-induced hearing loss. NIHL, the single most common work-related illness, is discussed next in detail in the manufacturing section of this guide.

When dealing with miners, it is important for the provider to think about generalized disorders that are encountered in other work environments as well as industry-specific diseases, such as CWP. Furthermore, obtaining an entire work history is crucial because some mining diseases, such as silicosis, may not appear until decades after the person has been removed from the exposure.

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Manufacturing
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The manufacturing sector focuses on transforming raw materials into goods that meet human needs. The industry as a whole is responsible for almost one-third of all occupational illness cases according to the U.S. Bureau of Labor Statistics. Most of the occupational diseases described in the mining section of this chapter are also therefore quite prevalent in the manufacturing industry. Workers are subjected to traumatic and repetitive musculoskeletal injuries, dermatitis, corneal injuries, especially with welding or chemicals, and occupational asthma as well as myriad other injuries and diseases. There are, however, a few ailments that are specific to the manufacturing sector; the most common of which is noise-induced hearing loss (NIHL).

Hearing Loss

Occupational NIHL is the single most common work-related illness. The Occupational Safety and Health Administration, overseen by the U.S. Department of Labor, and the National Institute for Occupational Safety and Health (NIOSH), overseen by the Centers for Disease Control and Prevention, both mandate and collect, respectively, audiometric yearly evaluations from workers who are subjected to excessively high occupational noise exposure. Such noise exposure is defined as exceeding 85 decibels (dB) over an eight-hour workday. Employers in these situations are required by OSHA to enroll their workers in a hearing-conservation program. Extended noise exposures that reach 85 dB can cause permanent damage to auricular hair cells, resulting in hearing loss. By comparison, a normal household blender usually operates at around 88 dB.

A hearing conservation program mandates that an employee must wear hearing protection and participate in regular audiometric evaluations. Occupational NIHL produces a specific audiometric elevation in hearing threshold at 4,000 Hz. This is known as the “4K hearing notch,” which is typical of occupational NIHL. Occupational hearing loss is such an important issue because it is very common and produces a devastating disability that is 100% preventable.

The prevalence of NIHL is actually greatest in the mining industry; however, manufacturing has the greatest number of workers exposed to continuous 85 dB on an eight-hour average and thus produces the greatest number of occupational NIHL patients.

Musculoskeletal Injuries

The manufacturing process involves significant repetitive upper extremity work. This results in an increased likelihood for cumulative overuse tendinopathies (see also Chapter 2, Musculoskeletal Injuries). It is important for primary care providers to recognize that a patient presenting with an upper extremity disorder may need not only treatment, but also working an injury classification.

Rotator cuff injuries are common and best treated with work restrictions that limit above-shoulder work and lifting. If a permanent disability results at the shoulder level, the permanent impairment rating is based on the range of motion (ROM) that is lost, as measured in forward flexion, extension, abduction, adduction, and external and internal rotation. If any of these ROM are impaired, providers can access the AMA Guides to the Evaluation of Permanent Impairment textbook, which has tables listing the impairment for each ROM abnormality—as well as for other
Diagnosis of elbow impairment is based on any lack of flexion, extension, supination, or pronation, as measured with a goniometer. The most common cumulative trauma disorder of the elbow is a lateral epicondylitis injury. It is best treated with rest and a “tennis elbow” splint. NSAIDs (oral and topical) and physical therapy are often used, but as with many such injuries, it is not certain that these help any more than simply “buying time” for the injury to heal on its own. Unfortunately, these overuse injuries tend to recur once the work restrictions are lifted unless engineering controls are implemented. In the manufacturing sector, such controls involve using better designed tools (such as with wider handles), fewer repetitive arm movements, and improved ergonomic controls.

Wrist tendinopathies include DeQuervain’s (DQ) tenosynovitis and carpal tunnel syndrome (CTS). DQ is an inflammation of the two tendons—abductor pollicis longus and extensor pollicis brevis—at the base of the thumb. On exam, the practitioner can elicit a positive Finkelstein maneuver, where the thumb is flexed down across palm with fingers flexed over and wrist extended laterally. A nighttime rigid wrist splint can be quite helpful, as it can be with carpal tunnel.

In CTS, the median nerve compression can be reproduced with Tinel’s sign and Phalen’s test. Interestingly, the occupational causation of CTS is not as well established as its association with obesity, diabetes, pregnancy, and hypothyroidism. Nonetheless, according to the Guides, CT surgery results in a 3% whole body impairment rating under worker’s compensation. Nerve conduction studies and electromyography are the mainstay of diagnosis after physical examination. A Jamar dynamometer is used to evaluate grip strength in occupational disorders that produce hand weakness.

Chemical Exposure

Theoretically, all hazardous chemicals used in the manufacturing process should come with a Material Safety Data Sheet (MSDS or SDS) produced by the manufacturer. This document contains important information on potential health hazards associated with working the chemical. It also contains information on its reactivity, fire potential, and environmental impact, as well as how to work safely with it. When an injury occurs from a chemical used in the manufacturing process, the treating health care provider can request a copy of the MSDS. As with all injuries, a company representative, should bring the worker to the health care provider, and bring along the MSDS. OSHA requires that every workplace maintain MSDSs for all hazardous chemicals used and make them readily available to all workers.

Many providers outside of the occupational health specialty are unaware that most chemicals used in manufacturing are absolutely unregulated. Most chemicals have never been formally tested for toxicity or carcinogenicity, and therefore it is not known if they are hazardous. NIOSH issues recommended exposure limits (RELs), and OSHA regulates permissible exposure limits (PELs) on what appears to be an enormous number of chemicals but is actually only a tiny proportion of those used in industry. The case of nanotechnology manufacturing illustrates this important point.

The last decade has seen a tremendous growth in nanotechnology, in both the medical and manufacturing industries. Use of these light, strong, microscopic particles (one-billionth of a meter)
shows great promise and benefit to society. However, their introduction has been so quick and widespread that we do not yet know the medical implications for workers handling them. NIOSH and OSHA are working to evaluate the health implications, but to date there are no regulations or occupational exposure limits (OELs) specific to nanoparticles. Inhaling nanoparticles could potentially cause pulmonary disorders similar to those related to the inhalation of pneumoconiosis-associated dust particles or at the very least result in sensitization and occupational asthma. Excretion of nanoparticles could in theory also cause glomerular and interstitial diseases, as well as the development of occupational skin disorders from prolonged contact.

Advances in technology can often outpace the medical understanding needed to support them safely. In the aerospace industry during the 1940s for example, we knew how to accelerate a body inside an aircraft to multiple Gs without fully understanding what the physiological and medical implications of such forces would be to an individual. Some portions of the manufacturing sector are on a similar path of high-tech growth and innovation—with possible medical implications.
The petrochemical industry is comparatively new, in existence only since the discovery in 1859 in Pennsylvania of a large enough quantity of crude oil to be of commercial value. Now the industry is measured in the trillions of dollars and significantly affects every facet of modern life, from transportation to clothing and from food to medicine. From the occupational medicine point of view, this giant industry can be separated into two major segments, extraction and processing—each of which presents a number of health risks to their workforces.

- Extraction is the segment of the industry that removes the raw material from the earth—the crude oil or the natural gas—and ships it to the user or the processor.
- Processing is the segment in which crude oil or gas is made into commercial products, including gasoline, diesel, olefins, benzene, toluene, methanol, polyvinyl chloride, and others. These products are eventually used by consumers or burned to generate energy.

Extraction

Oil- and gas-well drilling and servicing activities involve many types of equipment and materials. Recognizing and controlling their hazards is critical to preventing injuries and death. OSHA has recognized these industrial hazards, listed below, and has produced standards and enforcement guidelines for many of them:

- Vehicle collisions: A risk to employees whose worksites are far from home and who travel as a constant work requirement.
- Struck-by/caught-in/caught-between: The cause of many industrial fatalities, these risks particularly affect those working with cranes and oil derricks.
- Explosions and fires: A risk to those working with flammable material.
- Falls: A risk for workers who work at heights.
- Confined spaces: A risk for those who work with tanks, vessels, large pipes, and so on in confined spaces due to the threat of entrapment or gas exposure.
- Ergonomic hazards: A risk for those who work with heavy equipment requiring an unusual body position.
- High-pressure lines and equipment: A risk for workers who work with hydraulics and other pressurized lines.
- Electrical and other hazardous energy: A risk for workers in the vicinity of high-voltage lines.
- Machine hazards: A risk for workers who often operate machines or work closely with moving machines.

Processing

The petrochemical processing industry is made up of refineries and chemical plants. Workers in these facilities tend to live near their workplaces; therefore, commuting and associated risks are minimized. These workers also tend to perform the same familiar tasks on a daily basis, which reduces some risks. However, other risks remain, such as confined spaces, chemical exposures, and falls.
Chemical exposure risks are a special concern for primary care providers, because the consequences may not be acutely or readily apparent. OSHA regulations mandate routine medical surveillance or evaluation, or additional measures related to specific high exposures, for many chemicals. It also requires that employers provide those specific regulations to any medical providers who treat affected workers, to help determine the medical services to offer. Providers should carefully read the applicable medical requirements and regulations and understand that acute exposure incidences may require evaluations beyond routine surveillance. For example, the benzene regulation requires that “if an employee is exposed to benzene in an emergency situation, the employer shall have the employee provide a urine sample at the end of the employee’s shift and have a urinary phenol test performed on the sample within 72 hours.” The vinyl chloride regulation requires liver-function tests to include gamma-glutamyl transpeptidase (GGT). However, providers should exercise due diligence when they interpret laboratory test results. For example, not all elevated urinary phenol results are due to benzene, and the most common cause of elevated GGT is alcohol consumption.

There are also toxic chemicals to which workers may be exposed, such as phosgene and mercury, that surprisingly are not covered by specific OSHA regulations. Providers should understand the route of exposure and the potential for acute as well as delayed toxicity. Understanding the route of exposure can allow a more accurate estimate of the amount of the toxin that has been absorbed. For example, phosgene’s route of exposure is inhalation, and the pulmonary edema may not be apparent until after 24 hours after an acute exposure.

**Industry-Wide Safety Measures**

The petrochemical industry is understandably concerned with risk not only to individual workers and immediate coworkers but to the surrounding community as well. Workplace errors and incidents can cause significant explosions and environmental damage. Recognizing these added risks, the industry has put hefty resources into place to emphasize safety. One safety-measurement metric that the industry has adopted is the OSHA Recordable Incident Rate—by which companies calculate and report to OSHA their worker injury and incident rates per 100 employees.

In 2012, the U.S. Bureau of Labor Statistics reported the recordable incident rate for the *entire* manufacturing sector was 3.9 job-related injuries and illnesses per 100 full-time employees. By contrast, the AFPM’s own Occupational Injury & Illness Report recorded 0.5 incidents per 100 full-time employees, for both company employees and onsite contractors working at petroleum-refining facilities. Of these incidents, 79% of injuries were so minor that the worker returned to work immediately.

Given the emphasis by the industry on using the recordable incident rate as an indication of worksite safety, the potential exists for employers to become involved in the diagnosis and/or treatment of an injured employee. For example, managers may ask treating providers to encourage an employee’s early return to work, to avoid ordering unnecessary therapy, to refrain from using prescription medications when over-the-counter equivalents are also appropriate, or to refrain from writing prescriptions “just in case” they are needed later when diligent clinical monitoring would also be appropriate. As described in the OSHA recordkeeping section of this guide, managers may make these requests because certain medical orders and prescriptions will trigger an OSHA “recordable event.” Too many recordable events can make the manager of one site appear to be less effective on safety management than another site manager.
Health care providers must be aware that even subtle differences in the treatments they offer a patient can trigger an incident report or prevent one from being triggered. Providers therefore should be vigilant to make diagnoses based on objective rationales and base treatment recommendations on evidence-based medicine.
Transportation

Chunbai Zhang, MD, MPH

Transportation modes in the United States, including maritime, railway, aviation, and commercial motor vehicle (CMV), are essential engines of the U.S. economy. Operators with medical conditions that could impair alertness, decision-making abilities, or operational skills pose a large public health risk. Along with an aging U.S. transportation workforce, the prevalence of medical conditions such as heart disease, hypertension, and sleep disorders, which are associated with increased risk of sudden incapacitation, will increase in the coming decades.

Epidemiological data from the National Center for Health Statistics indicate that 13.7% of males between 45 and 64 have heart disease, and over 28% have hypertension. The National Sleep Foundation estimates that 4% of middle-aged men and 2% of middle-aged women experience excessive daytime sleepiness from sleep apnea. A government-mandated process, initiated by the National Transportation Safety Board (NTSB), has been put in place to minimize the risk of an employee performing a vigilance-requiring job if that person has a medical condition or takes medication that could compromise his or her ability to carry out the job safely. As a result, health care providers are often faced with examining high-risk operators and identifying any health risks that indicate the workers should be relieved of their duty to operate vehicles. It is, however, challenging to ensure that operators of aircraft, ships, trains, and trucks are medically fit to operate. This is in part because there are no uniform federal reporting laws or protections from liability for reporting unsafe transportation operators.

Fitness for Duty Requirements in the Transportation Industry

Medical fitness-for-duty standards in the transportation industry vary greatly. Among the most comprehensive and centralized exams is the Federal Aviation Authority (FAA) medical exam, which must be done by an FAA-designated Aviation Medical Examiner according to the standards set forth by the FAA Extension, Safety, and Security Act of 2016. New examiners are added only if there is a need in a particular region, determined by the regional federal air surgeon. Certification duration ranges from six months to three years depending on the aircraft class and age of the examinee.

In 2014, the Federal Motor Carrier Safety Administration adopted a similar centralized model, which requires federal Department of Transportation medical exams to be done by health care providers who are listed on the National Registry of Certified Medical Examiners. There is, however, no current quota on the number of these examiners. The U.S. Coast Guard (USCG) permits any state-licensed health care provider to perform its exams. Mariners need to meet the USCG medical and physical standards specified on a Merchant Mariner Medical Certificate (called a CG-719-K/E). Some CMV drivers (such as public school bus drivers) are covered under state medical standards, which are often based on federal standards, although waivers, grandfathered programs, and exemptions are not uncommon. The Federal Railroad Administration’s medical standards cover only locomotive engineers and conductors for vision and hearing under Code 49 C.F.R. §209.303. Operators of other forms of local transportation often are not regulated according to medical criteria, and many workers who drive as a part of their jobs merely need to hold a valid driver’s license.
Understanding Safety Risks: The Health Care Provider Role

Health care providers who determine the fitness for duty of employees who handle vigilance-requiring transport equipment must understand the safety risks involved in operating a motor vehicle, plane, ship, or train and their role in protecting the public from unsafe drivers. Providers should be well versed in all relevant federal or state regulations issued by agencies such as the FRA, FAA, USCG, and FMCSA covering operators’ occupations. They also need to be familiar with the job requirements of transportation operators who are not covered by the federal standards mentioned above. Providers should consider a patient’s current state of health, medical history, ongoing medical treatment, comorbidity, mental state, and functional capacity or impairments in determining fitness for duty.

A unique element of occupational medicine practice is that examinees may not be incentivized to disclose all medical conditions that may interfere with work safety. Providers must use objective criteria (if any) and third-party record review (if available) to make sound clinical judgments. For example, when screening for obstructive sleep apnea, simply asking if the patient has apnea or a history of snoring during sleep may not be a reliable way to determine whether a sleep screening study should be initiated. Furthermore, results of some portable sleep studies without chain-of-custody technology may have a low negative predictive value.

Monitoring for Fatigue and Other Conditions

The NTSB has noted that a leading factor in transportation accidents is fatigue. Employers must understand their responsibility for ensuring that all employees who operate a motor vehicle can do so safely. Workflow design, shift design, adequate rest, and screening for fatigue-related diseases need to be integrated into an employer’s safety program. Employers also need to ascertain that those who have either a medical condition or an acute change of health condition receive timely and appropriate medical evaluations by medical personnel who understand the medical condition and associated public safety risks. Employers should consider having workers with potentially impairing conditions monitored, which includes having independent medical examinations performed as needed. In some cases, employees might not willingly disclose conditions out of concern for becoming unemployable or incurring medical care costs. In some transportation sectors, employers provide financial assistance for screening and treatment of certain fatigue-related diseases, making employee medical fitness exams a win-win process: employers retain a healthier employee population, and employees identify previously undiagnosed diseases, gaining lifelong health benefits.

Health care providers must recognize the public safety risks inherent in clearing individuals with medical conditions that could impair their ability to safely operate a vehicle. Providers should remember to ask their patients whether they operate a CMV or other similar equipment as part of their job responsibilities. In a situation where the provider is uncertain of the patient’s medical history or ability to safely operate a vehicle, or is unsure of the regulations involved, he or she should consult with an occupational medicine specialist or someone else familiar with this information, or refer to online resources, some of which are listed at the end of this section.

Keep in mind that legally, medical standards programs must comply with the Americans with Disabilities Act (ADA), Health Insurance Portability and Accountability Act (HIPAA), and labor agreements. Still, courts have consistently found that safety considerations may limit ADA
application as a matter of law. HIPAA permits medical examiners to provide examination results to federal regulatory agencies and to other stakeholders named in state statutes.

Preventing employees from placing themselves or others at risk of harm due to an inability to perform their job tasks safely is a joint responsibility of employers, employees, and government entities.

Reducing this risk is of particular importance to health care providers who evaluate transportation workers for medical certification, because their decisions must ensure public safety, to the best of their abilities. To protect both transportation operators and the public, ACOEM urges providers, employers, employees, federal and state officials, and all others involved in the transportation industry to work as a team, as part of their professional responsibilities, to help ensure the medical fitness of all individuals who work in this industry.

For more information:

U.S. Department of Transportation. Federal Motor Carrier Safety Administration
Health care workers can encounter many harmful exposures in the workplace, including contact with body fluid, chemical and physical exposures, ergonomic issues, and violence. In general, the prevalent injuries that result can be divided into the categories of infectious disease, musculoskeletal injury, and, again, those related to assault.

**Body Fluid Exposures**

Body-fluid exposure can be broadly divided into two categories: needle-stick injuries and other contact with body fluid.

**Needle Stick Injuries**

Even after the introduction of retractable needles in the late 1990s, exposure to blood and blood products remains a major and common concern among health care workers. The estimated risk for infection after exposure to infected blood is roughly 0.3% for human immunodeficiency virus (HIV), 30% for hepatitis B virus (HBV), and about 10% for hepatitis C virus (HCV). Nurses are at the highest risk for this type of injury. The risk of infection increases with hollow-bore needles, needle devices that need to be taken apart or manipulated by the health care provider, syringes that retain and expose needles, and retractable butterfly needles, which can be difficult to dispose of in sharps containers.

Primary care providers need to know how to proceed in managing a health care worker with a needle-stick injury. Management should include an assessment of both the donor (usually the patient for whom the health care worker was caring) and the employee. Understanding the status of each person in terms of HIV, HBV and HCV is essential. The Occupational Safety and Health Administration’s [Bloodborne Pathogens Standard](https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=37140) (29 CFR 1910.1030) requires that employers make available immediate, confidential medical evaluation and follow-up for workers who have had exposures such as needlesticks. Post-exposure prophylaxis for HIV, HBV, and HCV, when medically indicated, must be offered to the exposed worker, according to the [Centers for Disease Control](https://www.cdc.gov).

**Other Contact with Body Fluid**

The chief risk of exposure to body fluid occurs when a health care worker has an open wound. It is therefore of primary importance to cover open wounds, especially the areas such as the hands that come in contact with patients, surfaces, and instruments. Infection can arise through direct contact with the body fluid of a person with an infectious disease or through splashes with water contaminated with infected saliva or blood, particularly during dental hygiene or dental procedures. For janitorial staff, the risk generally comes from cleaning a contaminated area in a health care facility. Orthopedic surgeons may be more prone than other health care workers to puncture wounds due to the prevalence of bone spikes in the operative field and the use of sharp instruments such as drills, saws, and wires.
Infections

Health care workers are susceptible to a variety of infections. These include tuberculosis and methicillin-resistant Staphylococcus aureus (MRSA). Some transmissions, including severe acute respiratory syndrome (SARS) and Ebola, have been lethal to infected workers. Primary care providers must screen patients effectively and be prepared to implement isolation procedures. Infection control is extremely important in preventing the spread of infection among other staff and patients.

Violence in Health Care Facilities

According to the World Health Organization, health care workers around the world are at high risk for violence. Between 8% and 38% of health care staff suffer physical violence at some point in their careers. Others are threatened or verbally abused. Most violence is perpetrated by patients, visitors, or to a lesser extent, residents of nursing homes. Incidences in which a client or patient has assaulted a health care worker account for 75% of aggravated assaults against employees and 93% of all assaults against employees. These injuries, of course, contribute to days away from work, including short- and long-term disability. In some cases, the return to work is further complicated by the development of posttraumatic stress disorder. Health workers most at risk for violence include nurses and other staff directly involved in patient care, emergency room staff, and paramedics.

Shiftwork

Shiftwork is recognized as any arrangement of daily working hours other than standard daylight hours (7 a.m. – 6 p.m.). Health care workers involved in shiftwork may suffer from short sleep duration or sleep disturbances. One-third of those who work shifts may not get enough sleep. Shiftwork and long work hours are associated with reduced neurocognitive performance, depression, insomnia, obesity, hypertension, stress, cardiac conditions, and injuries. Shiftwork that involves circadian disruption is considered, albeit with limited evidence, a factor in the development of breast cancer. In addition, fatigued health care workers are at higher risk for motor-vehicle accidents.

Work-Related Musculoskeletal Injuries

Musculoskeletal disorders have been found to be the most common occupational injuries and illnesses among hospital workers in the United States. They are a serious problem especially among nurses and nursing home staff who carry out direct patient-care tasks including lifting, transferring, and repositioning of patients.

Chemical Injuries

Depending on the facility and type of service health care workers provide, they may be exposed to chemicals through cleaning products and sanitizing agents, acrylics, medications including cytotoxic agents, and anesthetic agents and metals such as mercury, to name a few. Therefore facilities must maintain updated lists of all such products used onsite. Training staff on how to handle accidents such as spills is critical.
Radiological Injuries

The potential for exposure to isotopes and X-ray radiation is a risk for those workers administering these tests. Health care facilities must educate staff on what to do in case of incidental exposure. For this purpose, the U.S. Centers for Disease Controls and Prevention offers a helpful publication, “Emergency Preparedness and Response: Radiation Emergencies,” on its website.

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Tanisha Taylor, MD, MPH, CPE, FACOEM
Chief Medical Director, RWJBarnabas Health Corporate Care
Dr. Taylor is chief medical director of RWJBarnabas Health Corporate Care in the RWJBarnabas Healthcare System. She serves on the board of the Occupational and Environmental Medical Association of New Jersey and American College of Occupational and Environmental Medicine. Dr. Taylor completed a residency in internal medicine at Yale University followed by a fellowship at the Yale Occupational and Environmental Medicine Fellowship program. Dr. Taylor completed medical
school at New York Medical College in Valhalla, New York.

Andy Yorgason DO, MPH, MHPE, FACOEM  
Clinical Assistant Professor, Arizona College of Osteopathic Medicine of Midwestern University  
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Dr. Andy Yorgason graduated from West Virginia University’s occupational medicine residency. He has been a guest researcher at NIOSH, a medical advisor for workers’ compensation, and a clinical chair for dozens of other occupational health providers in a medical center setting. He operates a small occupational medicine consulting company serving the nuclear power industry and provides medical director services to mid-size companies.

Chunbai Zhang, MD MPH  
Occupational Medicine Physician, UW-Medicine Valley Medical Center  

Dr. Chunbai Zhang is a graduate of Haverford College, Geiser School of Medicine at Dartmouth, and Harvard School of Public Health. He is ACGME-trained in internal medicine (Tufts), occupational medicine (Harvard), and sleep medicine (Harvard). Dr. Zhang also holds a Certificate of Value-Based Healthcare Delivery from Harvard Business School. He is a director of the Northwest Association of Occupational & Environmental Medicine and treasurer of ACOEM's International Section.