

## Guidance for Occupational Health Services in Medical Centers

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### INTRODUCTION

*Guidance for Occupational Health Services in Medical Centers* is dedicated to the memory of Dr. Geoff Kelafant, who was tragically killed in a diving accident in March 2004. Geoff was the original author of a set of guidelines for the practice of occupational health in medical centers; his work established a format and content upon which we continue to expand with the current guidance document. Geoff's enduring legacy is the profound impact he made upon medical center occupational health care in the United States and Canada.

### PURPOSE OF THIS GUIDANCE DOCUMENT

This document represents a collation of pertinent guidelines, best practices, and professional opinions applicable to the practice of occupational medicine in the medical center setting. It is intended to assist hospital-based occupational medicine practitioners handle the broad range of issues they encounter when tasked by their employers to focus on the health and safety of workers in the health care environment. The document and its hyperlinks will be updated periodically to incorporate new information as it becomes available.

### ROLE OF THE MEDICAL CENTER OCCUPATIONAL HEALTH PROVIDER

#### MEDICAL ASSESSMENT OF EMPLOYEES

Occupational health practice in a medical center setting requires the same skills needed in any occupational health practice setting, including thoughtful administrative management; knowledge of and interactions with safety, industrial hygiene, and toxicology; and sound preventive and clinical medicine, including surveillance, assessment of history and physical findings, diagnosis, treatment, rehabilitation and disposition.

#### Preplacement Medical Evaluation

The preplacement medical evaluation (PPME), also known as a post-offer preplacement assessment (POPA), usually represents the first clinical encounter for a prospective employee, setting the tone and defining expectations from occupational health services (OHS). The PPME, which must be done after the offer of a job, serves to document medical issues that are likely to have an impact on the new employee's performance, health and safety in the health care work setting. It is not designed to diagnose or treat previously undiscovered medical problems which do not impact the workplace or work performance. The [Americans with Disabilities Act \(ADA\)](#) of 1990 required job descriptions that identify the "essential functions" of the job to be offered, with specific, precise descriptions and terminology with which employee capabilities must be compared. OHS should gather enough information to ensure that employees' medical and functional status enables them to perform the essential functions of the job. OHS should outline the specific constraints and restrictions that human resources (HR) can use to determine appropriate accommodation where feasible and appropriate. Specific diagnoses or other clinical information should not be released.

Since the last update of this guidance document, the [Genetic Information Nondiscrimination Act \(GINA\)](#) was enacted in 2008. This legislation prohibits discrimination against employees or applicants based on genetic information, which could include family history. To reduce the likelihood of such discrimination, employers in the health care industry have frequently built "firewalls" between the occupational health record and the medical record that the institution uses to house patient data. The occupational medicine physician reporting to human resources (HR) must be cognizant on which side of the firewall he/she is standing when making such reports, particularly if that physician works at a small facility. Such awareness also applies to subsequent roles in reporting surveillance data and work status to HR or supervisors. Each facility will need to coordinate with legal counsel and administration to determine the exact format appropriate for that organizational culture.

State laws differ, but occupational physicians must be aware of local licensing and skill requirements. In general, they must act as a resource for nurse- and advanced-level provider-based evaluations and should be involved in any communication with HR about restrictions or failure to meet medical or functional standards for the offered job. Refusal to clear someone for work must be based on the inability of an individual to perform the essential elements of the job, or not meeting specific standards. For example, a known alcoholic in acute relapse may not be suitable for hire, if existing policy states as such, but a cocaine addict who has completed rehabilitation cannot be refused employment on that basis alone. Conditions identified during the course of the PPME, such as elevated blood pressure, should be communicated to the individual with recommendations for follow-up, preferably in writing. New employees should also be fully informed of any recommended restrictions shared with HR.

As noted above, the PPME documentation ideally should be housed in a record/database separate from the institution's medical record for patient care, primarily for access at a later date and to clarify the purpose of the data for evaluation rather

than general health care. Of course, the data should be available to medical providers if the new employee wishes to release the information to them according to the [Health Information Portability and Accountability Act \(HIPAA\)](#) of 1996 rules. The medical record must be kept for 30 years following termination of employment.

Other evaluations, such as drug testing, commercial driver certification, baseline medical status before working with hazardous chemicals, immunization status, examinations for respirator clearance, or tuberculosis surveillance status may be required before starting work, but some may be delayed until specific job assignments have been clarified. Specific regulations apply to some functions, such as flight examinations or drug testing, requiring specific certification by designated agencies such as the Federal Aviation Administration (FAA) or testing and certification as a medical review officer under Department of Transportation (DOT) requirements.

### **Periodic Medical Evaluation**

The health care workplace represents a hazardous environment (see Hazards sections). Engineering and administrative controls should precede the use of personal protective equipment, but medical surveillance for adverse health effects from hazardous exposures often represents good medical practice and is required by federal and even some state laws for specific hazards.

Surveillance is recommended for tuberculosis, and the Occupational Safety and Health Administration (OSHA) enforces the [Centers for Disease Control and Prevention \(CDC\) guidelines on tuberculosis](#) as regulation. OSHA and the [National Institute for Occupational Safety and Health \(NIOSH\) recommend surveillance for employees exposed to hazardous drugs](#), despite a lack of robust scientific support for benefits or utility. For exposures to certain substances, e.g., ethylene oxide, formaldehyde, lead, asbestos, cadmium and ionizing radiation, federal OSHA standards ([29 CFR, Part 1910, subpart Z](#)) require medical surveillance when action levels are exceeded.

Most states have an “impaired provider” program for licensed individuals with mental, physical, or chemical dependence conditions that may impair their ability to practice safely. OHS is often part of the administrative process that initially reports such providers to state licensing board(s) and subsequently monitors those providers to ensure compliance with the Board recommendations. Clear understanding of the regulations, understanding of privacy issues, as defined in HIPAA and other regulations, and unambiguous communication, together with strict confidentiality in behavior and recordkeeping, are essential for successful practice.

### **Episodic Medical Evaluation**

#### *Job Transfers*

Since different jobs have different physical requirements, the preplacement medical evaluation is specific to the job. Therefore OHS should have an agreement with HR to review employees who are transferring to jobs that have specific physical and/or mental requirements. This may only require a review of the employee’s current medical status, particularly any temporary or permanent restrictions affecting work performance. If a face-to-face evaluation is normally required for the new job, many institutions require the transferring employee to undergo that same evaluation. If a record review suggests a substantial mismatch of skills and requirements or simply a lack of information, OHS should contact the employee for clarification or a face-to-face evaluation.

#### *Illness/injury Affecting Work Performance*

Work-related injuries and illnesses are best evaluated and managed by an occupational health provider in OHS. While health care workers may have the right to seek care elsewhere, the advantages of care from an in-house provider are straightforward. Convenience (access to physical therapy and other modalities), familiarity with the work site, and communication ease with supervisors generally facilitate care and recovery. OHS must carefully maintain good relationships with all parties, understand and respect employee/supervisor relationships, and maintain a patient/employee focus in clinical management. For those employees seeking care elsewhere who have restrictions or a prolonged duration of time away from work, the OHS provider should periodically contact the employee and request authorization to communicate with the treating provider. The treating provider should provide regular information on progress, as required by workers’ compensation statutes. OHS often acts as the clearinghouse for communication between other providers and the employee’s supervisor and/or HR.

Non-occupational injuries or illnesses should be managed similarly to work-related conditions if they affect work performance. Particularly in the case of contagious diseases, OHS providers should evaluate the employee before he/she returns to work or establish criteria for returning to work with the attestation of the employee’s attending physician. Some facilities have a policy requiring OHS clearance after a certain minimum consecutive days off work. Home or sports injuries may also require evaluation to determine restrictions in the workplace. As a service to the employee and to minimize time away from work, OHS may offer limited acute care services, such as throat cultures, ear lavage, rash evaluation, etc. Such services serve several purposes. They help employees build trust in OHS as they rely on its providers. In addition, travel time to and from physician

offices is shortened, minimizing time away from work. Conditions with potential implications for coworkers and patients can also be identified early. Medical evaluation/treatment should be provided for bloodborne pathogens and other infectious exposures, traumatic or ergonomic-related injuries, chemical exposures, and other work-related events. OHS should establish specific protocols and arrange 24/7 coverage.

#### *Job Fitness Evaluation*

Immediate evaluation may be necessary when a worker on duty is exhibiting dangerous or unacceptable behavior: verbal or physical assault, lapses into unconsciousness, alcohol odor on breath, slurred/garbled speech, etc. Such evaluations should begin with a report from the supervisor of the specific behavior in question. The supervisor should escort the employee to OHS. The employee should not be released to work until OHS has conducted or arranged for a thorough history, physical, and any necessary consultation/testing. If the worker is expected to return to work in some capacity, the cost of the evaluation should be borne as a business expense while records are kept confidential. OHS only reports to the supervisor that the behavior was or was not related to an unspecified medical condition and when and under what conditions the employee may return to work. The OHS physician may need to comply with HR policy regarding workers impaired in the workplace, including periodic visits or random drug testing, essentially mirroring the periodic monitoring described above for licensed health care workers. The OHS physician must protect worker privacy to the extent possible while reassuring HR and the supervisor that the worker is safe for duty, as the worker has demonstrated a lapse in readiness for duty in the past. Any such contractual arrangement should be between HR and the employee; the OHS physician facilitates compliance with that contract.

Consultative visits may be arranged with OHS on a scheduled basis if either a supervisor or a worker recognizes that work performance is impaired by a real or perceived medical condition. It is important to have the OHS function evaluate individuals who display behaviors that may be related to a medical or psychological condition. Having a checklist of examples of these behaviors is a useful resource to supervisors, HES and HR professionals; and, education/training for these individuals is essential. OHS can evaluate the worker, coordinate optimal control of the medical condition, and recommend restrictions/accommodations that will maximize success in the workplace. OHS must resist the temptation to attribute all performance deficits to a medical condition, thereby “medicalizing” either poor motivation, relationship conflicts, or lack of skills. This caveat is true in any work environment, but the tendency to “medicalize” may be particularly tempting in a health care environment.

<https://www.ada.gov/>

<https://www.eeoc.gov/laws/statutes/gina.cfm>

<http://www.hhs.gov/hipaa/>

<http://www.cdc.gov/tb/default.htm>

<http://www.cdc.gov/niosh/topics/hazdrug/default.html>

[https://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=10147](https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10147)

#### *MEDICAL DIRECTION*

##### **The Unique Setting of OHS in Health Care**

Development and management of OHS in a health care setting is a daunting task and requires constant awareness of the distinction between the mission of the organization (health care delivery) and the unit (occupational health services delivery). Five principles are essential to establish a proper relationship with key members of the organization:

- 1) **Title:** Although the OHS director in non-clinical industries is usually called the corporate medical director, that title may be impolitic in health care, particularly if the organization is “physician-led.” Thus, the title of “Medical Director, OHS” clarifies the difference between mission leadership and “line operations” support.
- 2) **Reporting relationship:** The OHS medical director should have ready access to the senior management of the medical center. OHS can provide case management to ensure proper care, appropriate restrictions, and timely return to duty after an illness or injury, but such work with HR and supervisors often encounters resistance around job limitations and may require top management support.
- 3) **Role as a specialist:** The OHS medical director must be able to assure colleagues in other disciplines that OHS is not in the business of “stealing” or diverting patients from other providers. Medical colleagues are often unaware of the specialty of occupational medicine and its contents. The OHS medical director must clarify the role of OHS for colleagues in family medicine, orthopedics, etc. and be recognized as a specialist, expert in the management of disability, hazardous exposures, workers’ compensation and the interface of medical care with legislative requirements and regulations ([FMLA](#), [ADA](#), [HIPAA](#), OSHA standards, CDC guidelines, etc.). Consultation services and support to colleagues struggling with such issues for outside care, including workers’ compensation, are important in developing a role.
- 4) **Institutional visibility:** The medical director of OHS must develop alliances with organizational units that may be foreign to other physicians in the medical center, including safety, human resources, infection control, industrial hygiene,

engineering, facilities management, environmental services, purchasing, and the institution's insurance carrier. Assignment to key committees and attendance at meetings; establishment of policies supported in the institutional framework; and presence in the various areas during rounds and problem solving are key to maintaining an effective presence.

- 5) **OHS staff:** Success as medical director of OHS relies upon the relationship with occupational health nurses and other staff. Frequent meetings, philosophical alignment, and respect of each other's skills and opinions represent the foundation of a successful program. Nursing staff should be trusted to administer jointly developed policy and procedures, handle phone calls from employees, serve as internal case managers for disabled employees, and run programs addressing PPMs, blood and body fluid exposure, TB surveillance, etc. Advanced-level providers can manage much of the clinical volume. Staff may benefit from regular attendance at meetings ([AOHP](#), [AAOHN](#), [ACOEM](#)), and they need accessibility for informal "curbside" consults or to transfer management of a difficult case.

### **Disability Management**

Individual cases should be followed in OHS if they meet certain criteria: restrictions affecting work performance; prolonged time off work; or work-related injury/illness requiring ongoing treatment/restrictions. Case management requires differing levels of intensity depending on the severity/duration of the disability. At a minimum, a nurse case manager should monitor medical records and work status reports from other providers with the option for direct communication with the employee or referral to the medical director/designee for evaluation. OHS must be careful to have authorization from the employee/patient to communicate with the supervisor and administration (see medical records and [HIPAA](#)). Population-based disability management is no different in health care than in any other industry and works most effectively when OHS, HR, and the insurer(s) share the same database(s).

Return-to-work programs may be housed outside of OHS but require constant communication with OHS for clarification of restrictions and comparison of temporary work assignments. Ideally, alternate, "transitional" work should be available whether restrictions arise from an occupational or non-occupational condition. OHS staff can serve as a resource to supervisors to coordinate the smooth and rapid return to work either in the original assignment or in another job within the organization. The success of this program depends on HR absence policies, disability benefits, and pay/reporting rules, i.e., whether the supervisor retains the restricted employee on his/her payroll while on modified duty. As importantly, worker satisfaction and relationship with co-workers and supervisor represent more subtle, but equally powerful forces. Again, OHS must be vigilant to avoid "medicalizing" relationship issues and to help to negotiate a return to some useful function within the organization.

### **Health Benefits Administration**

Some input from OHS may be useful as employers construct health benefit plans for employees. In particular, occupational medicine providers may play a role in arranging employer-sponsored programs to address general home and workplace safety, healthy dietary choices, age-specific cancer screening recommendations, biometric screening, smoking cessation, disease management, and other preventative health efforts. OHS staff often serve as a resource to remind employees when they might benefit from an available service.

### **Employee Assistance Program (EAP)**

EAP in the health care setting is particularly valuable for de-escalation of relationship issues in the workplace. EAP does not establish an on-going relationship with the worker as a patient and generally does not bill on a fee-for-services basis. Such services may be obtained through an outside vendor, but there may be advantages to keeping EAP services "in house." The medical director may want to serve as a liaison to the EAP for oversight/advice about policies and particular cases as well as to gather data on any trends in employee dissatisfaction or specific categories of problems. When particular problems arise in a work area, an EAP counselor can serve in an organizational development role to guide the workers in that unit to a reasonable reconciliation before individual members develop performance deficits or symptoms of distress. Confidentiality and maintenance of trust require a great deal of attention with in-house EAP units, both in selection of a physical location and in maintenance of confidentiality.

### **Medical Records**

In order to satisfy [HIPAA](#), OHS must decide whether it is part of the practice of the health care organization or part of the administration. This influences how records are stored (firewall), who has access to which elements (role-based access), and whether a signed release is needed (HIPAA-compliant release). While individual circumstances may vary, it is usually preferable to place OHS as part of the practice. This allows free communication between the medical director/OHS staff and other providers in the organization.

OHS must have specific authorization from the employee/patient to release any medical information to the supervisor/administration. Generally, OHS will not need to share medical information with the employer, even with a release.

Communication regarding work status should be devoid of protected health information. Medical records and documentation

generally should be housed in a record/database separate from the institution's medical record for patient care. It should include pre-placement, medical surveillance, infectious disease and workers' compensation records. The records should not be accessible to professionals without involvement in direct care of the employee. Still, the data should be available to health care providers if the employee wishes to release the information.

<https://www.dol.gov/whd/fmla/>

<https://www.ada.gov/>

<http://www.hhs.gov/hipaa/>

<http://www.acoem.org/default.aspx>

<http://www.aaohn.org/about-us/aaohn-vision-and-mission/aaohn-fact-sheet.html>

<https://www.aohp.org/aohp/>

## HEALTH CARE SAFETY AND OCCUPATIONAL HEALTH

Hospital systems accreditation organizations, such as [The Joint Commission](#), require that facilities have a safety program. Such programs require skills in safety, industrial hygiene, engineering, environmental management, housekeeping, workers' compensation, and clinical disciplines. Programs generally consist of written policies, require some form of internal inspection and quality assurance, and rely on defined approaches to the solving of recognized problems. Establishment of top management commitment to safety, health, and environmental management (SHEM) represents a core value for health care organizations.

Such accrediting bodies require some form of recordkeeping. Although OSHA logs ([1904.7](#)) often represent the formal output, they are not focused on employers' overall injury prevention program. Many facilities and employers have developed complex systems to bring the various disciplines together in a single community of practice. This is generally collected in a committee called, in health care, an "Environment of Care" Committee (EoCC), a safety committee, or some other organizational unit with regular meetings, minutes, a strategic plan, and formal reporting relationships to hospital leadership. The data systems on which such committees rely are often far more extensive than the OSHA 300 log. Understanding the true causes of incidents, i.e., looking beyond the actions of the injured worker, relies on a process called root-cause analysis, widely used in the world of safety. In health care settings, understanding events may require detailed assessment of patient care systems, nursing notes, and other documentation.

Health care safety staff often take the lead, but OHS clinician collaboration in several core functions is essential for the successful administration of these programs.

- a) The Hazards section of this document identifies hazards for which the hospital (internal or consulting) safety staff should develop programs. Many of these require medical surveillance programs, medical evaluation for fitness and capacity, and medical support for failures.
- b) Safety investigations of adverse incidents to employees benefit from the establishment of incident review boards. Such investigations identify what should have occurred, what actually occurred, and why the two diverged in an attempt to prevent the next occurrence. Such groups generally function better when they are composed of individuals with a wide variety of skills (safety, engineering, clinical) and diverse viewpoints (management, professional, and employee representatives). Many facilities establish some fixed set of criteria by which incidents for review are selected (all lost time cases, or all diseases, or all cases costing more than a set sum of money, or events by quarterly frequency of occurrence). Some organizations have included "near misses" in their reviews.
- c) Scheduled evaluations of the environment of care (safety rounds) can identify newly occurring hazards, inurement to hazards and worsening work practices. Walk-throughs with safety, employee health, and employee representatives remain an important tool for safety management.
- d) Annual written reports of money spent, costs saved, and services delivered remind management of the value of programs

<https://www.jointcommission.org/>

[https://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9638](https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9638)

## BIOLOGICAL HAZARDS

### MODES OF TRANSMISSION

Health care workers may be exposed to a variety of biological hazards. As discussed below, effective immunization and infection control programs, as well as appropriate post-exposure evaluation and medical management policies must be established. Common bloodborne pathogens include HIV, hepatitis B, and hepatitis C; uncommon pathogens include syphilis, Ebola and Zika viruses, other viral diseases, and malaria. Pathogens transmitted via the airborne route include tuberculosis, measles, varicella, and under certain conditions such as during aerosol generating procedures, smallpox, hemorrhagic fevers,

SARS, and possibly influenza. Droplet- transmitted pathogens include meningococcus, pertussis, Hemophilus influenzae, M. pneumoniae, Group A streptococcus, mumps, rubella, adenoviruses, parvovirus and influenza. Infections spread by skin exposure include Herpes simplex, papilloma virus and fungi. Enteric pathogens include hepatitis A, salmonella, shigella, and norovirus. Research institutions may present special challenges, such as those associated with handling animals or biological agents that require special facilities.

**Table 1.-Diseases Spread by Droplet or Airborne Transmission**

Disease	Organism	Clinical Manifestations	Health/Personal Care Workers at Risk
Adenovirus	Adenovirus	Rhinitis, pharyngitis, malaise, rash, cough	All – especially those in intensive care units, long-term pediatric care facilities and ophthalmology clinics
Influenza	Influenza virus	Fever, chills, malaise, cough, coryza, myalgias	All, especially physicians and nurses
Measles (Rubeola) (airborne spread)	Rubeola virus	Fever, rash, malaise, coryza, conjunctivitis, Koplik's spots, adenopathy, CNS complications	All
Meningococcal disease	Neisseria meningitides	Fever, headache, vomiting, confusion, convulsions, petechial rash, neck stiffness	Emergency medical personnel, emergency department staff, microbiology lab personnel
Mumps	Mumps virus	Painful/swollen salivary glands orchitis, meningoencephalitis	All, especially pediatricians, dentists, daycare workers
Pertussis	Bordetella pertussis	Malaise, cough, coryza, lymphocytosis, "whooping" cough	All, especially pediatric health care workers, urban workers
Parvovirus B19	Parvovirus B19	Rash, aplastic anemia, arthritis, myalgias	All, especially nurses
Respiratory Syncytial Virus ( <i>principally spread by contact</i> )	RSV	Respiratory symptoms	All, especially pediatric health care workers
Rubella	Rubella virus	Fever, malaise, coryza, rash	All
Tuberculosis (airborne spread)	Mycobacterium species	Fever, weight loss, fatigue, pulmonary disease, extra pulmonary involvement including lymphatic, genitourinary, bone, meningeal, peritoneal, miliary	All, especially nurses, pathologists, laboratory workers, housekeeping staff
Varicella (airborne and contact spread)	Varicella zoster virus	Chickenpox, disseminated zoster	All

**Table 2. Diseases Spread by Percutaneous or Mucous Membrane Contact with Blood or Body Fluids**

Disease	Organism	Clinical Manifestations	Health/Personal Care Workers at Risk
Hepatitis B	Hepatitis B Virus	Malaise, arthralgias, fatigue, anorexia, nausea, vomiting, diarrhea, constipation, rash, fever, abdominal pain, jaundice, hepatosplenomegaly, adenopathy	All, especially nurses, laboratory workers, surgeons, dentists, dialysis workers
Hepatitis C	Hepatitis C virus	Often asymptomatic. Malaise, arthralgias, fatigue, anorexia, nausea, vomiting, diarrhea, constipation, fever, abdominal pain, jaundice, hepatosplenomegaly, adenopathy	All, especially nurses, laboratory workers, surgeons, dentists, dialysis workers
AIDS/HIV Infection	Human Immunodeficiency Virus	Adenopathy, fever, weight loss, fatigue, chronic diarrhea, anemia, leukopenia, oral candidiasis, opportunistic infections certain cancers, neurologic symptoms	All, especially nurses, laboratory workers, surgeons, dentists, dialysis workers
Viral hemorrhagic fevers including Lassa fever, Marburg virus, Crimean hemorrhagic fever, Ebola virus	Hemorrhagic fever viruses	Wide spectrum of symptoms, some degree of hemorrhagic symptoms and complications	All, especially nurses
Other diseases that have been transmitted via percutaneous injuries (laboratory, research facilities)		Blastomycosis, Brucellosis, Cryptococcosis, Dengue Fever, Diphtheria, Gonorrhea, Herpes Simplex, Leptospirosis, Malaria, Mycoplasmosis, Rocky Mountain Spotted Fever, Scrub Typhus, Herpes B Virus, Sporotrichosis, Staphylococcal Disease, Streptococcal Disease, Syphilis, Toxoplasmosis, Tuberculosis, Yellow Fever, Creutzfeldt-Jacob disease	

**Table 3. Diseases Spread via Fecal-Oral Route**

Disease	Organism	Clinical Manifestations	Health/Personal Care Workers at Risk
Helicobacter pylori	Helicobacter pylori	Gastric ulcers	Endoscopy personnel
Hepatitis A	Hepatitis A virus	Gastrointestinal symptoms, malaise, jaundice, hepatomegaly	All, especially neonatal nurses
Norovirus	Norovirus	Gastrointestinal symptoms	All, especially nurses and care
Polio	Poliomyelitis virus	Also weakness, headache, stiff neck, fever, nausea and vomiting, sore throat	All
Salmonellosis	Salmonella species	Gastrointestinal symptoms, fever, bacteremia, carrier state possibly	All, especially nurses and laundry workers
Shigellosis	Shigella species	Gastrointestinal symptoms	All, especially nursery nurses

**Table 4. Diseases Spread by Skin Contact**

Disease	Organism	Clinical Manifestations	Health/Personal Care Workers at Risk
Herpetic Whitlow	Herpes simplex	Vesicles, pruritus	All, especially dentists, anesthesiologists, dialysis technicians, physical therapists, physicians, nurses
Tinea corporis ringworm	Microsporum, trichophyton	Ring shapes lesions or scaly lesions on body	All
Warts	Papilloma virus	Dermatologic manifestations which vary widely in shape, size, and appearance	Dermatologists
Staphylococcal Infections	MSSA, MRSA, VISA, VRSA	Skin lesions, invasive infections, systemic disease	All

**INFECTIO CONTROL PRACTICES**

Appropriate training and policies to minimize patient-to-employee and employee-to-patient transmission of communicable disease are essential. Effective surveillance activities should also be in place to prevent transmission of communicable diseases and to diminish absenteeism.

Policies and procedures should include:

- 1) Thorough preplacement evaluation, including documentation of immunizations or evidence of immunity, TB surveillance testing, and orientation to communicable disease work restrictions.
- 2) Periodic re-evaluation to encourage preventive activity and use of personal protective equipment.
- 3) Initial and periodic mandatory training in the use of personal protective equipment (PPE) and standard precautions.
- 4) Periodic review of employee lists to assure adequate numbers and training of employees for respirator use.
- 5) Establishment of policies and procedures to place patients who may harbor active infection with an airborne transmissible agent into negative pressure isolation, and assurance that caregivers are provided effective respiratory protection.
- 6) Immunization review and updating of programs.
- 7) Ongoing tuberculosis screening requirements to include employees, volunteers, students, and medical staff.
- 8) Care of personnel for work-related exposures and illnesses.
- 9) Monitoring exposures to infectious disease.
- 10) Maintenance of employee health records.
- 11) Providing educational sessions and literature encouraging work and personal hygiene.
- 12) Establishing work restriction programs to prevent transmission of communicable disease.

<http://www.cdc.gov/hai/>

<http://www.cdc.gov/vaccines/adults/rec-vac/hcw.html>

<http://www.cdc.gov/handhygiene/>

<http://www.cdc.gov/MMWR/preview/MMWRhtml/rr5210a1.htm>

<http://www.cdc.gov/hicpac/2007IP/2007isolationPrecautions.html>

<http://www.cdc.gov/hicpac/pdf/InfectControl98.pdf>

<http://www.cdc.gov/niosh/topics/healthcare/>

<http://www.shea-online.org/>

<http://www.apic.org/>

*Suggested immunizations for health care facility employees*

A number of immunizations may be indicated or considered in health care workers depending on the risk of exposure or the infection risk to patients. These vaccinations include:

- *Diseases for which immunization is strongly recommended* – Hepatitis B, measles, mumps, rubella, influenza, varicella, pertussis
- *Diseases for which immunization/prophylaxis may be indicated* – hepatitis A, meningococcal disease
- *No increased risk among health care workers, but should be current* – diphtheria, tetanus
- *Special circumstances, including research and animal labs* – rabies, Q fever, polio, vaccinia, others as appropriate for circumstances

<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6007a1.htm>

<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6002a1.htm>

<http://www.cdc.gov/vaccines/hcp/acip-recs/index.html>

*Needlestick injuries and other bloodborne pathogen exposures*

Needlestick injuries remain a significant cause of health care worker injuries. OSHA requires that employers determine classes of employees who are reasonably anticipated to have exposure to blood or other potentially infectious material. A written bloodborne pathogen exposure control plan must specify how at risk employees are identified and trained about their risks, and how compliance with recommended precautions and implementation of personal protective equipment will be implemented. The plan also must specify how non-supervisory staff are queried for input. Sharps with engineered safety features should be regularly reviewed, trialed, and implemented where feasible. Needles should not be recapped or broken before disposal. Puncture resistant containers should not be filled to capacity. Needlestick injuries require determination of worker and source (wherever possible) serological status with respect to hepatitis B and C and HIV. Appropriate consents to HIV test the worker and source may be necessary; regulations vary by State. Under special circumstances, some states allow for source patient testing without the permission of the source patient. Recommendations and practices regarding bloodborne exposures change frequently and policies should regularly be reviewed and updated. Generally, serological follow-up of the health care worker exposed to HIV, HBV, or HCV has been carried out at baseline, 6 weeks, 3 months, and 6 months following exposure. HIV serological follow-up can be shortened to 4 months when a fourth generation assay is used. Recent CDC guidance suggests that follow up of hepatitis C-exposed health care workers using HCV RNA testing may rule out infection within as few as three weeks of exposure. Current guidance with respect to prophylaxis or early treatment of specific infections should be followed (see specific bloodborne pathogens below).

In all cases of confirmed HBV, HCV, or HIV exposures, which include mucous membrane exposures as well as “sharps” exposures, clinical evaluation with a knowledgeable health care provider should be offered as soon as practicable, e.g., within 1-2 hours, to the exposed employee. Standard first aid should be provided for all needlestick injuries, cut and bite wounds, including washing the injury site. If the exposure is to the eyes, copious irrigation should be performed immediately. Benefit and risk information regarding antiretroviral medications should be discussed when there is a possibility of HIV exposure, and medications should be prescribed in accordance with currently applicable U.S. Public Health Service guidance. Information should be provided regarding availability of follow-up counseling. The employee should be advised to report any illness which occurs within the initial six-month period following exposure, particularly skin rashes, fever, malaise, joint pain, abdominal pain, muscle aches, enlargement of lymph nodes, and any acute infections. Instructions on the use of condoms or abstinence to prevent sexual transmission of HIV during the six months following potential exposure should be given. Women of childbearing age should be checked for pregnancy if they elect to take prophylactic medication.

<http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=9369442&fileId=S0195941700033671>

<https://www.osha.gov/SLTC/bloodbornepathogens/index.html>

<http://www.cdc.gov/niosh/topics/bbp/>

<http://www.cdc.gov/niosh/docs/2008-101/>

<http://www.cdc.gov/hepatitis/pdfs/testing-followup-exposed-hc-personnel-3d.pdf>

*Health care workers infected with a bloodborne pathogen:*

Preplacement testing for bloodborne diseases is a controversial issue. Workers' compensation precedent in some states assumes that a health care worker who has contracted a bloodborne disease must have acquired it as a result of an occupational exposure unless there is compelling evidence to the contrary. Preplacement testing, where legal, may serve to protect the employer from future liability as well as making the employee aware of the presence of a potentially debilitating

disease. When a bloodborne pathogen is identified, practitioners should consult experts in the field regarding evaluation and treatment. Preplacement testing to identify chronic infection with hepatitis B is recommended by the CDC for certain high-risk groups. CDC does not specifically recommend HIV or HCV testing as part of preplacement evaluation. Baseline postexposure-testing can rule out pre-existing infection for these pathogens.

HCW's infected with a bloodborne pathogen may hesitate to admit that they are infected out of fear that this will restrict their careers. Depending upon institutional policies, those who perform invasive procedures may need to adhere to protocols which may impact certain aspects of their practice; however, most health care workers can work safely with their infections. In general, surgeons infected with a bloodborne pathogen should seek counsel from an institutional expert advisory panel regarding any specific procedures to be adhered to in their practice to avoid transmission to a patient. Guidance from the Society for Healthcare Epidemiology of America (SHEA) has addressed in comprehensive fashion the management of infected health care workers.

<https://www.cpsa.on.ca/uploadedFiles/members/membership/shea-guideline.pdf>

<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6103a1.htm>

<http://www.cdc.gov/mmwr/preview/mmwrhtml/00014845.htm>

### *Hepatitis B*

Hepatitis B vaccination has resulted in a 98% decline in HBV incidence among health care workers during the past 30 years. Without vaccine protection, percutaneous exposure to HBV-infected blood is associated with a seroconversion risk of 1-6% if a source patient is e-antigen negative, but 22-31% if the source patient is e-antigen positive. HBV is resistant to drying, ambient temperatures, simple detergents and alcohol, and may survive on environmental surfaces for up to one week.

Workers with reasonably anticipated potential blood and body fluid exposure must, according to federal regulation, be offered vaccination for hepatitis B. Health care workers who decline to be vaccinated should sign a written declination form, as specified in the OSHA Bloodborne Pathogen Standard. Those previously vaccinated for hepatitis B should have documentation of hepatitis B surface antibody response to the vaccine. Hepatitis B surface antibody testing should be carried out among previously vaccinated personnel without such documentation. Because hepatitis B surface antibody titers wane with time without compromising immunity, a negative hepatitis B surface antibody test several years following completion of vaccine does not necessarily mean an individual has not responded to the vaccine. Reasonable management of such individuals as a part of the pre-placement evaluation includes a single booster of vaccine, followed 4-6 weeks later by retesting of hepatitis B surface antibody. Those who remain hepatitis B surface antibody-negative should have the vaccine series repeated, with surface antibody testing thereafter. Because chronic hepatitis B infection is a reason for vaccine non-response, non-responders should be tested for the presence of hepatitis B surface antigen. In general, vaccine non-responders should receive hepatitis B immune globulin if exposed to a hepatitis B-positive source patient.

<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6210a1.htm>

<http://www.cdc.gov/vaccines/vpd-vac/hepb/default.htm>

<http://www.cdc.gov/hepatitis/index.htm>

### *Human Immunodeficiency Virus (HIV)*

Routine patient contact has not been found to increase worker risk of acquiring HIV. Health care workers should be trained, retrained and mandated to follow CDC standard precautions guidelines. Personnel should minimize the risk of exposure to parenteral or mucosal contact with potentially infectious body fluids. Appropriate personal protective equipment and training should be available and mandated.

A 0.3% risk of HIV infection following needlestick exposures is commonly quoted. Seroconversion among health care workers in recent years has become extremely uncommon, likely attributable to widespread use of postexposure antiretroviral prophylaxis, as well as generally lower viral loads among source patients adherent to HIV therapy. Characteristics that may be associated with higher risk of seroconversion include deep injury, visible contamination of the device with blood, needle placement directly into an artery or vein, or exposure to an individual with elevated viral titers. Risk of seroconversion following mucous membrane exposure has been estimated at 0.09%, based on one seroconversion in six studies.

In addition to following the basic protocol for HIV exposures, the need for prophylaxis with antiretroviral medications should be evaluated on an individual basis by the employee health physician, and drugs should be made quickly available (preferably within one or two hours) in accordance with currently applicable U.S. Public Health Service guidance, and provided free of charge. After the initial baseline HIV antibody is drawn, the employee should receive recall notices for follow-up HIV antibody testing at appropriate intervals for at least 6 months unless the source patient has been identified as not having HIV or another

bloodborne pathogen. A follow-up period of 4 month is regarded as adequate when 4th generation blood testing is used for follow-up. Informed consent and confidential reporting are key elements of any HIV surveillance activity.

<http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=9369442&fileId=S0195941700033671>

<http://www.cdc.gov/hiv/>

<http://nccc.ucsf.edu/>

### *Hepatitis C*

Following percutaneous exposure to infected blood, risk of hepatitis C seroconversion among exposed health care workers ranges from 0 to 10%, with an average risk of 1.8%. Infection following mucocutaneous exposure appears to be much less common. Antibodies to HCV may be detected within 5-6 weeks of infection, and may persist regardless of whether virus is actively replicating. Most individuals have no acute symptoms.

The management of patients acutely infected with hepatitis C is a topic of current discussion. No hepatitis C vaccine is available, and administration of immune globulin is ineffective. Several studies have demonstrated the efficacy of interferon alpha2b in treating acute hepatitis C. One report demonstrated long-term viral clearance in 98% of subjects when interferon alfa-2b was begun during acute disease at an average of 3 months following infection. Newer HCV treatments have demonstrated long-term viral clearance in as many as 95% of treated individuals, even when chronic disease is established. Studies of such agents in the treatment of acute hepatitis C are ongoing. It has been shown that symptomatic patients with acute hepatitis C are more likely to spontaneously clear the virus than are patients with asymptomatic infection. Given the high cure rates associated with current pharmacologic therapies, there is no role for prophylactic treatment of individuals exposed percutaneously or mucocutaneously to hepatitis C-infected blood or body fluids. Acute therapy should be considered for seroconverters if spontaneous remission has not occurred within 6 months of seroconversion; pharmacotherapy should be selected in accordance with current guidance for treatment of chronic hepatitis C.

<http://www.cdc.gov/hepatitis/HCV/index.htm>

<http://www.cdc.gov/hepatitis/hcv/management.htm>

<http://www.cdc.gov/hepatitis/hcv/labtesting.htm>

<http://www.hcvguidelines.org/full-report/management-acute-hcv-infection>

### *Enteric pathogens*

Dietary personnel should have prompt evaluation and treatment of any gastrointestinal disease. Prompt reporting of gastrointestinal illnesses should be required, and re-evaluation prior to return to work is essential. HR policies that provide paid sick time for such illness may encourage employee compliance. Good handwashing technique, use of non-latex disposable gloves, and proper training should be encouraged and reinforced.

Hepatitis A virus is found in serum, stool and liver only during acute infections. IgM antibody identifies acute infection while IgG anti-hepatitis A indicates prior HAV exposure with immunity to recurrent infection. Hepatitis A vaccine may be indicated in certain high-risk settings.

<http://www.cdc.gov/foodsafety/diseases/>

<http://www.cdc.gov/hepatitis/HAV/index.htm>

### *Influenza*

Influenza is one of many infectious diseases for which health care workers are at risk. A robust influenza program reduces exposure through systematic patient screening to identify and appropriately isolate potential influenza patients. Standard and Droplet precautions are recommended for health care workers caring for patients with influenza. For pandemic influenza, enhanced precautions, including N95 respirators, should be used in accordance with OSHA and CDC guidance. For patients with significant diarrhea, contact precautions should be added. If spray or splatter of infectious material is likely, goggles or face shield should be worn according to standard precautions. All staff should be trained to practice good hand hygiene and cough etiquette, and febrile workers with respiratory symptoms should be supported by policy to remain home until they have been afebrile for 24 hours without antipyretic medications.

Annual influenza vaccination provides additional protection for this population; among healthy adults, vaccine effectiveness averages 59% based on studies conducted over the past four decades. (Osterholm, see reference below) Prophylaxis with antiviral medications may still be indicated for unvaccinated health care workers during institutional outbreaks, and even for vaccinated workers in seasons of lower vaccine effectiveness. Influenza vaccine should be offered to all employees free of charge and strongly encouraged among employees with potential direct patient contact. Multi-pronged influenza vaccination programs including "flu vaccine fairs," decentralized or unit-based vaccination, coverage of all employee shifts, coupled with

assertive education campaigns are some of the best practices for increasing vaccine uptake and can reliably achieve vaccination rates over 70%. To consistently achieve vaccination rates over 90%, health care institutions may decide to require annual vaccination. Institutions with mandatory influenza vaccine policies benefit from the advice and counsel of the occupational physician to ensure that policies and procedures protect health care worker confidentiality, that exemption decisions are made fairly and consistently, and that the importance of a comprehensive influenza program is emphasized. Until such time as a more effective vaccine is developed, vaccination remains but one tool in the arsenal against influenza transmission.

There is no evidence to support the routine use of surgical masks by asymptomatic personnel, regardless of vaccination status, as a means to prevent influenza transmission by the worker to patients or coworkers. The assumption that asymptomatic individuals pose a significant transmission risk is not well supported in the literature. (Lau, Patrozou) Existing evidence supports the use of either masks or respirators to protect the HCW, especially when bundled with hand hygiene and other infection control measures. (Apisarnthanarak, Jefferson) There is some evidence that surgical masks are effective at limiting transmission to others when worn by a febrile, symptomatic, influenza patient.

### References for influenza section

- Apisarnthanarak A, Uyeki TM, Puthavathana P, et al. Reduction of seasonal influenza transmission among health care workers in an intensive care unit: a 4-year intervention study in Thailand. *Infect Control Hosp Epidemiol*. 2010;31(10):996-1003. <https://drive.google.com/file/d/0B7L5Bcgcpa-ySV9vSXFJYWdmakk/edit>
- Jefferson T, Del Mar C, Dooley L, et al. Physical interventions to interrupt or reduce the spread of respiratory viruses. *Cochrane Database Syst Rev*. 2011;(7):1-162. <https://drive.google.com/file/d/0B7L5Bcgcpa-yVmtRdkVORGdPd1U/edit>
- Lau LLH, Cowling BJ, Fang VJ, et al. Viral shedding and clinical illness in naturally acquired influenza virus infections. *J Infect Dis*. 2010;201(10):1509-16. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3060408/>
- Osterholm MT, Kelley NS, Sommer A, Belongia EA. Efficacy and effectiveness of influenza vaccines: a systematic review and meta-analysis. *Lancet*. 2012;12(1):36-44. [http://www.thelancet.com/pdfs/journals/laninf/PIIS1473-3099\(11\)70295-X.pdf](http://www.thelancet.com/pdfs/journals/laninf/PIIS1473-3099(11)70295-X.pdf)
- Patrozou E, Mermel LA. Does influenza transmission occur from asymptomatic infection or prior to symptom onset? *Public Health Rep*. 2009;124(2):193-6. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2646474/>  
<http://www.cdc.gov/flu/professionals/infectioncontrol/healthcaresettings.htm>  
<http://www.cdc.gov/flu/professionals/infectioncontrol/maskguidance.htm>

### Pneumococcal Disease

Current guidelines from the CDC should be consulted to determine the need for pneumococcal vaccine based on the employee's age, medical history, and potential work and non-work exposures.

<http://www.cdc.gov/vaccines/vpd-vac/pneumo/vacc-in-short.htm>

### Varicella

Health care workers should have their varicella immune status documented at time of preplacement examination. Documentation of positive varicella antibodies, receipt of 2 doses of varicella vaccine, or clinician-documented chicken pox or herpes zoster is regarded as adequate evidence of immunity. Those with negative, unknown, or undocumented histories of varicella should have their immune status determined by a varicella zoster virus titer. Health care personnel without evidence of varicella immunity should receive two doses of varicella vaccine, 4-8 weeks apart. If skin lesions occur post-vaccination, the affected employee should be restricted from patient care until lesions are crusted. Work restrictions are otherwise not necessary for newly vaccinated personnel.

Varicella-susceptible health care workers who are exposed to varicella should be furloughed from the eighth day following initial exposure to the twenty-first day following last varicella exposure. Health care workers whose immunity to varicella is from vaccine, rather than from natural disease, should be instructed to monitor themselves for fever, rash and systemic symptoms during the same postexposure interval, and should be furloughed if symptoms develop.

Employees infected with varicella should be restricted from patient work until all lesions are dried and crusted. Immunocompetent employees with localized zoster should be restricted from caring for high-risk patients until lesions are crusted, but may care for other patients as long as lesions are covered. Immunosuppressed employees with localized zoster may have respiratory shedding of virus and should be restricted from patient care until lesions are crusted. The single-dose zoster (shingles) vaccine is indicated for adults over age 60, regardless of varicella immunity history.

<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6007a1.htm>

<http://www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/varicella.html>

*Measles, Mumps, Rubella*

Health care workers should have documented immunity to measles, mumps and rubella (MMR). Adequate proof of immunity consists of documented vaccination (2 doses MMR, >28 days apart with first dose after 1st birthday), laboratory documentation of protective titers, laboratory documentation of disease, or birth before 1957. (Because a limited number of individuals born before 1957 may not be immune to measles, mumps or rubella, health care facilities may choose to require MMR vaccination for this group if there is no other evidence of immunity. In the setting of a measles, mumps or rubella outbreak, vaccination with two doses of MMR also is recommended for those born before 1957 who do not otherwise have evidence of immunity.) MMR vaccine should not be administered during pregnancy and specific instructions should be provided regarding avoidance of conception for at least 3 months. Because it is a live virus vaccine, MMR should not be administered to individuals with severe immunosuppression.

If inadvertent exposure occurs to an infected patient, non-immune health care workers should be furloughed from day 5 following first exposure until day 21 following last exposure for measles, from day 12 following first exposure until day 25 following last exposure for mumps, and from day 7 following first exposure until day 23 following last exposure for rubella (or seven days following onset of rash if the health care worker develops it).

<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6007a1.htm>

<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6204a1.htm>

<http://www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/mmr.html>

<http://www.cdc.gov/vaccines/hcp/acip-recs/index.html>

*Pertussis*

More than one million adults and adolescents are estimated to contract pertussis annually in the United States. Several outbreaks of pertussis have occurred in health care settings, and disease is spread avidly by droplets and direct contact. The Tdap acellular pertussis vaccine for adults has been approved since 2005, has an efficacy ranging from 66-92%, and is recommended for health care workers. Following pertussis exposure, vaccinated individuals may still contract subclinical disease or be contagious to others. Hence, antibiotic prophylaxis is still recommended for vaccinees following unprotected exposure if they are likely to have contact with high-risk patients, e.g. neonates, immunocompromised patients or pregnant women. Exposed health care workers without high-risk patient contact are recommended to receive either antibiotic prophylaxis or daily symptom monitoring for 21 days, with antibiotic treatment only if symptoms of pertussis develop.

<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5517a1.htm>

<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6007a1.htm>

<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6001a4.htm>

<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6125a4.htm>

<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6207a4.htm>

[https://www.acoem.org/uploadedFiles/Public Affairs/Policies And Position Statements/Guidelines/Position Statements/Pertussis Vaccination of Health Care Workers.pdf](https://www.acoem.org/uploadedFiles/Public%20Affairs/Policies%20And%20Position%20Statements/Guidelines/Position%20Statements/Pertussis%20Vaccination%20of%20Health%20Care%20Workers.pdf)

**TUBERCULOSIS:**

Although the incidence of active tuberculosis (TB) has fallen steadily in the US over the past 2 decades, exposure is an ongoing risk for health care workers (HCWs), particularly those who work with higher risk populations. An increasing percentage of TB cases in this country result from reactivation of disease in foreign-born persons, particularly those from countries with high TB case rates. Other significant risk factors for TB include HIV and other immune-compromising conditions, incarceration, and homelessness. Given the insidious onset of this disease, and the nonspecific nature of presenting symptoms including fever and cough, HCWs may easily be exposed before diagnosis and before initiating effective engineering controls and PPE. Health care institutions should maintain TB control programs addressing early identification, early isolation, appropriate use of PPE, HCW TB screening, and treatment of latent TB infection (LTBI) among HCWs to decrease the risk of transmission and infection.

**Administrative and Engineering Controls:** TB transmission occurs via inhalation of *Mycobacterium tuberculosis* droplet nuclei produced by coughing, other exhalations, or disruption of surgical, pathologic, or microbiologic specimens. Administrative policies should guide HCWs to have a high index of suspicion for patients (and specimens) with TB infection potential, and to initiate airborne isolation as early as possible with the goal of maintaining engineering controls until TB infection is ruled out, and for the duration of infectious potential if TB is ruled in. Engineering controls can include negative pressure rooms with adequate air exchanges, appropriate venting of contaminated air, high-efficiency particulate air filter units, and germicidal irradiation (where available). In ambulatory settings and during transport, when these resources are limited, patients with suspected TB should be temporarily masked to prevent transmission.

Diagnosis of active TB in a source patient usually depends on imaging followed by microbiologic confirmation of *M tuberculosis*. A syndromic approach for patients with febrile cough illnesses facilitates pre-emptive isolation and masking in order to protect HCWs and other patients until a specific diagnosis can be made. This approach has the added benefit of reducing transmission risk for other respiratory pathogens.

**Personal Protective Equipment:** HCWs caring for patients with known or suspected active TB infection must wear respiratory protection. This is particularly crucial during high-risk procedures for aerosolization such as bronchoscopy, endotracheal intubation, sputum induction, surgery and autopsy. Acceptable respiratory protection for *M tuberculosis* protection consists of a fit-tested N95 respirator or a powered air-purifying respirator (PAPR). HCWs should be medically cleared for respirator use and trained annually. Reevaluation is indicated if a HCW has significant weight loss or physical changes that could affect respirator fit and/or safe use. Beards generally preclude effective use of N95 respirators that depend on tight fit for effective filtration of infectious aerosols. Hospitals may opt for any combination of N95 and PAPR use that meets their TB control needs and provides satisfactory respiratory protection.

**Screening HCWs for TB:** The purpose of TB screening is to exclude active TB disease and identify LTBI in HCWs. TB surveillance screening for HCWs must be done on hire and after known TB exposures (at baseline and 8-12 weeks afterwards). Initial TB screening, required at the time of hire whenever a HCW changes employers, must comprise either “2-step” TB skin testing (TST) or a single Interferon-Gamma Release Assay (IGRA). In addition, health care facilities that exceed minimal risk for HCW exposure must perform periodic testing with a frequency based on current CDC guidelines. TST and IGRAs are both currently approved for HCW surveillance testing for LTBI. (Neither test is approved for the diagnosis of active TB.) TSTs have the advantage of many decades of epidemiologic data on the correlation between skin test results and reactivation, whereas the more recently licensed IGRAs are more specific in detecting prior exposure to *M tuberculosis* versus positive tests from prior BCG vaccination or exposure to some atypical mycobacteria.

Either test methodology can be used for HCW screening. Results should be interpreted and reported using specific criteria for what constitutes a positive test. For TSTs, 10 mm induration at 48-72 hours is considered positive for most HCWs; however, if they have known recent exposure or known immune compromise, 5 mm induration is considered positive. For IGRAs, the manufacturers’ cut-offs for positive are used, although recent analyses indicate that using a higher quantitative result may be more clinically meaningful. IGRA recommendations are likely to evolve with more experience and as new enhancements become available for laboratory diagnostics.

For either methodology, screening should include a symptom review. Chest x-rays are indicated to rule out active TB disease for any newly positive screening test or symptoms suggestive of active TB in a HCW. HCWs with imaging consistent with active TB disease must be furloughed until infection is ruled out by sputum studies (or treated). HCW conversions (i.e. from a negative screening test to a positive screening test) should be tracked carefully by occupational health staff to identify clusters and guide TB control planning. Converters should be asked about exposure risks at work and during travel, particularly if they provide care in high-risk areas at home or abroad. Follow up imaging is not recommended routinely after conversion with a normal chest x-ray.

**Treating TB in HCWs:** Active TB is rare in HCWs and should be treated according to usual guidelines beginning with four antimicrobials. Infected HCWs should be monitored carefully for treatment compliance as they recover and may return to work when asymptomatic with serial sputa negative by microscopy.

LTBI, defined as a positive screening test with normal imaging and no relevant symptoms, is much more common. HCWs with LTBI should be offered treatment to reduce the risk of reactivation TB. LTBI treatment is widely underutilized, but increasingly important as more people are able to work with immune-compromising conditions that increase the risk of reactivation. Currently recommended regimens include 9 months of isoniazid, 4 months of rifampin, or 12 weeks of weekly directly observed isoniazid and rifapentine. During treatment, HCWs should be monitored for hepatotoxicity on all regimens.

However, the lack of any “gold standard” test for LTBI, combined with potential drug toxicity, often complicates treatment decisions. Occupational health clinicians should consider all available clinical data with their HCW patients. In some circumstances, serial screening and/or the use of both TSTs and IGRAs may be helpful in judging the relative risks of reactivation and treatment, although this approach is not yet reflected in national guidelines.

In the end, clinicians should manage LTBI based on their analysis of a HCW’s screening tests, medical risk for reactivation and hepatotoxicity, and prior exposure history (particularly for HCWs who lived or trained in endemic areas). This is essentially a Bayesian approach. Interactive TB reactivation risk calculators can provide useful support. HCWs with established positive TSTs or IGRAs who have been evaluated for (and accepted or not accepted) LTBI treatment should continue to receive annual education and may need to complete periodic questionnaire screening for symptoms suggestive of active disease.

<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6410a2.htm>

<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5417a1.htm>

[https://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=12716](https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=12716)

<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5905a1.htm>

Thanassi W, Noda A, Hernandez B, et al. Delineating a retesting zone using receiver operating characteristic analysis on serial QuantiFERON Tuberculosis test results in US healthcare workers. *Pulmonary Med.* 2012. Article ID 291294. Available at: <http://www.hindawi.com/journals/pm/2012/291294/>. Accessed April 17, 2017.

McGill University. The On-line TST/IGRA Interpreter 3.0: <http://www.tstin3d.com/index.html>

### *Emerging Infectious Diseases*

The management of an emerging infectious disease represents one of the most important and difficult challenges for the medical center-based occupational health physician. Severe Acute Respiratory Syndrome (SARS) in 2003, Novel H1N1 influenza in 2009, and more recently, Middle Eastern Respiratory Syndrome (MERS), and Ebola Virus Disease (EVD) have demonstrated the potentially high hazard faced by frontline health care workers encountering infectious patients, particularly during the interval between initial presentation to a medical center and imposition of isolation precautions.

Key issues to be addressed in preparing medical centers to triage and manage patients with infectious diseases whose virulence and transmission characteristics may not be fully understood include education of staff regarding the epidemiological and clinical features with which patients may present (often enhanced by automatic triage questions within an electronic medical record); application of a low threshold for isolating patients who may harbor disease; imposition of standards for PPE which err on the side of being more rather than less protective when mode of transmission has not been fully elucidated; thorough training and repeated drilling of PPE donning and doffing with checks to be certain contamination events do not occur during doffing procedures; systems for frequent communication with staff; procedures to assure specimens are received and handled safely in clinical laboratories; systems for contact tracing and regular monitoring of potentially exposed staff members; and a triage procedure for exposed and symptomatic staff which allows for clinical evaluation under appropriate isolation.

Guidance often evolves during the emergence of an infectious disease, requiring the occupational health physician to remain abreast of new developments and standards on a daily basis. The Hospital Emergency Incident Command System (HEICS) will frequently be activated when one or more patients are admitted with an emerging infectious disease. It is critical for the occupational health physician to maintain a prominent role within the HEICS structure as the principal content expert responsible for maintaining the safety of the health care workforce.

<http://www.cdc.gov/sars/index.html>

<http://www.cdc.gov/coronavirus/mers/hcp.html>

<http://www.cdc.gov/vhf/ebola/>

<http://www.cdc.gov/vhf/ebola/healthcare-us/index.html>

<http://www.emoryhealthcare.org/ebola-protocol/ehc-message.html>

<http://www.nebraskamed.com/biocontainment-unit/ebola>

<http://www.who.int/csr/disease/ebola/protective-measures-staff/en/>

### *Agents of Bioterrorism*

Occupational health practitioners in medical centers should be involved in institutional initiatives to prepare for bioterrorist attacks. The CDC classifies agents of bioterrorism into three categories. Category A diseases/agents are those which can be easily disseminated or transmitted from person to person; which result in high mortality rates and have potential for major public health impact; which might cause public panic and social disruption; and which require special action for public health preparedness. Category B disease/agents are considered moderately easy to disseminate; result in moderate morbidity rates and low mortality rates; and require specific enhancements of diagnostic capacity and enhanced disease surveillance. Category C diseases/agents include those that could be engineered for mass dissemination in the future due to their availability, ease of production and dissemination, and potential for high morbidity and mortality rates.

Category A agents include *Bacillus anthracis* (anthrax), *Clostridium botulinum* toxin, *Yersinia pestis* (plague), *Variola major* (smallpox), *Francisella tularensis* (tularemia), and the viral hemorrhagic fevers (Ebola, Marburg, Dengue, Hanta, Rift Valley Fever, Crimean Congo Hemorrhagic Fever, Junin, Machupo, Guanarito, Chapare, Lassa, and Lujo). Category B agents include *Brucella* species (brucellosis), Epsilon toxin of *Clostridium perfringens*, food safety threats (*salmonella* species, *Escherichia coli* O157:H7, *Shigella*, others), *Burkholderia mallei* (glanders), *Burkholderia pseudomallei* (melioidosis), *Chlamydia psittaci* (psittacosis), *Coxiella*

burnetii (Q fever), Ricin toxin, Staphylococcal enterotoxin B, Rickettsia prowazekii (typhus fever), viral encephalitis (Venezuelan equine encephalitis, Eastern equine encephalitis, Western equine encephalitis, West Nile virus, others]), and water safety threats (e.g., Vibrio cholerae, Cryptosporidium parvum, others). Emerging infections such as Nipah virus and Hendra virus, as well as sizable list of others including SARS, MERS, Prions and Chikungunya are considered to be Category C agents.

Agents of bioterrorism vary in their propensity for transmission from person to person. Guidelines addressing infection control in medical center settings, vaccinations, prophylactic therapies and other issues pertinent to medical center preparedness can be accessed on the CDC web site.

<https://emergency.cdc.gov/bioterrorism/>

<https://emergency.cdc.gov/planning/>

#### **LABORATORY AND ANIMAL HANDLING BIOSAFETY**

Academic medical centers frequently share campus space and staff with biomedical researchers and lab animal husbandry workers. Hence the occupational health physician is often involved in surveillance, preventive care and postexposure management for employees with exposure risks far beyond those inherent in usual health care settings. Concomitantly, occupational health providers are integral to institutional regulatory compliance related to lab animals and biohazards. This section provides an overview of biosafety concerns for laboratory and animal handler staff, with the exception of overlapping issues related to handling human tissues which are covered elsewhere in this document. Comprehensive reviews and dynamic updates on this topic are available in a variety of web sites and publications, including those listed below. The objective here is to provide a framework to understand, anticipate and approach issues of workplace infection and allergy in this population.

The majority of workplace infections are zoonotic, including nearly all pathogens of concern for research labs. Understanding the epidemiology, transmissibility and disease mechanisms of these agents may allow us to protect workers from primary infection and sequelae. At the same time, we can prevent transmission to workers' families, colleagues and communities. Relevant vaccines should be strongly encouraged, and immediate evaluation of any suspected exposure or disease should be mandatory to facilitate postexposure management.

A team approach offers the greatest safety benefits. Occupational health staff in these settings should routinely collaborate with their facility's institutional biosafety committee, emergency department, risk management, animal care and use committee (IACUC), laboratory animal veterinarians, biosafety officers, and other environmental health and safety staff in creating protocols and responding to events. Local public health authorities and the CDC can provide expertise and resources; contact information should be immediately available in the clinic.

**Designing and maintaining occupational health programs for animal/research facilities begins with risk and hazard assessment** based on the specific animals, pathogens, and procedures in use. Occupational health physicians should consider site visits to laboratories and animal facilities if needed to guide their recommendations. Pathogens for each protocol are assigned an NIH-defined risk group (Table 5) and a CDC biosafety level (Table 6). These designations define and drive required laboratory and personal protective equipment as well as standard operating procedures to minimize risk for staff. Animal biosafety levels define additional facilities requirements.

#### **Key principles in research laboratory occupational health and safety programs include:**

- a. Education and training for all staff with updates for all new protocols and documentation of competencies to prevent and manage exposures
- b. Post-hire and periodic medical surveillance evaluations for early detection of allergy or illness, vaccine updates, and confidential counseling on risks
- c. Controlled access to research areas to exclude staff lacking training and medical clearances
- d. Facility design and maintenance including appropriate biosafety cabinets and other protective equipment
- e. PPE appropriate to each protocol and worker
- f. Decontamination equipment and training appropriate to each protocol and pathogen, including showers, eye wash stations, and scrub kits. In all cases where occupational infection risks are associated with a wound or mucous membrane exposure, copious irrigation is the critical first step in care.
- g. Containment of pathogens and chemical hazards after spills
- h. Optimal waste management
- i. Specimen transport protocols
- j. 24/7 access to medical care and appropriate postexposure prophylaxis after possible exposure with indicated clinical follow-up

**Surveillance programs** for research lab and animal handlers should be risk-based. Medical evaluation is recommended on hire and then at least annually. Statistically, the greatest risk for animal handlers is occupational allergy. The risk is increased in atopic individuals and can be life-threatening with severe asthma or anaphylaxis. Animal workers should be monitored regularly and educated on the symptoms of new or worsening allergy so they can seek immediate care. Surveillance can be based on screening questionnaires, administered during a clinic visit or online; however, web-based tools may miss staff with language barriers or fears of job loss. Direct medical evaluation is indicated for any worker reporting new or worsening allergy or asthma symptoms. Baseline and periodic spirometry, targeted to atopic or symptomatic individuals, can detect early deterioration. PPE including respiratory protection can be effective in preventing new or worsening sensitization, but some individuals require removal from particular lab areas or species. Skin testing may be useful to narrow the range of species that a sensitized animal worker must avoid.

Surveillance is also designed to identify and mitigate infectious risk for medically vulnerable workers. Immune-compromised workers are at greater risk of infection and complications from many workplace infections. With current medical advances, the population of workers well enough to function on immune-modulating medication is increasing rapidly. Although laboratory and animal husbandry protocols should be designed to protect all staff, additional work restrictions may be appropriate in some cases, ideally developed in collaboration with the worker's other treating physicians. Similarly, pregnancy increases medical risk for many pathogens. Pregnant staff should also be offered counseling and appropriate accommodation.

**Pathogens:** Research institutions should maintain a registry of pathogens in use. Occupational health providers should be aware that laboratory exposures may entail greater inoculums and different clinical presentations than naturally acquired infections. A full review of laboratory and lab animal pathogens is beyond the scope of this guideline, but distinctive management concerns include the following:

- a) Select agents are defined as biological agents and toxins that have the potential to pose a severe threat to public, animal or plant health. Possession and handling of these pathogens are strictly regulated by federal law (Bioterrorism Preparedness Act).
- b) Nonhuman primates can transmit several serious human diseases. Of these, macaque species are of particular concern because they can be asymptomatic carriers of B Virus, a herpesvirus with >70% mortality in untreated humans. All macaque facilities should have targeted training, decontamination, and treatment protocols meeting national guidelines.
- c) Rabies researchers/staff dealing with wild or feral animals should have pre-exposure immunization and seromonitoring.
- d) Poxvirus researchers should be offered Vaccinia vaccination as well as counseling specific to poxvirus risk factors such as atopic dermatitis.
- e) Bite injuries from cats, dogs, primates, and large mammals should receive prophylactic antibiotics in many cases.
- f) Q fever, carried by cattle, sheep, and goats, is notable for infection after very small inoculums; exposed staff should be closely monitored for early treatment to prevent endocarditis and other sequelae.
- g) Toxoplasmosis is extremely dangerous to pregnant and immune-compromised patients. Post-exposure prophylaxis regimens are available but toxic. Serial serologic monitoring may be useful for management decisions.

**Table 5. Classification of Infectious Microorganisms by Risk Group**

Risk Group	NIH Guideline	Examples
RG 1	Agents not associated with disease in healthy adult humans.	Adeno-associated virus (AAV), asporagenic Bacillus subtilis, Escherichia coli K-12 Host Vector Systems
RG 2	Agents associated with human disease that is rarely serious and for which preventive or therapeutic interventions are <i>often</i> available.	Staphylococcus aureus, Cryptococcus neoformans, Toxoplasma, Hepatitis B virus
RG 3	Agents associated with serious or lethal human disease for which preventive or therapeutic interventions may be available (high individual risk but low community risk).	Mycobacterium tuberculosis, West Nile virus, Yersinia pestis
RG 4	Agents likely to cause serious or lethal human disease for which preventive or therapeutic interventions are not usually available (high individual risk and high community risk).	Lassa virus, Herpesviruses simiae, Ebola virus

Source: adapted from the BMBL 5th Ed., 2007.

**Table 6 – Recommended Biosafety Levels for Infectious Agents**

BSL	Agents	Practices	Primary Barriers/Safety	Facilities (Secondary Barriers)
1	Not known to consistently cause diseases in healthy adults	Standard microbiological practices	None required	Lab bench and sink
2	Agents associated with human disease • Routes of transmission include percutaneous injury, ingestion, mucous membrane exposure	BSL-1 practice plus: • Limited access • Biohazard warning signs • “Sharps” precautions • Biosafety manual defining any needed waste decontamination or medical surveillance policies	Primary barriers: Class I or II BSCs or other physical containment devices used for all manipulations of agents that cause splashes or aerosols of infectious materials.  PPE*: Laboratory coats; gloves; face protection as needed	BSL-1 plus: • Autoclave available. • BSL-2 Signage. • Negative airflow into laboratory • Exhaust air from laboratory spaces
3	Indigenous or exotic agents with potential for aerosol transmission • Disease may have serious or lethal consequence	BSL-2 practice plus: • Controlled access • Decontamination of all waste • Decontamination of laboratory clothing before laundering	Primary barriers: • Class I or II BSCs or other physical containment devices used for all open manipulation of agents PPEs: • Protective laboratory clothing; gloves; respiratory protection as needed	BSL-2 plus: • Physical separation from access corridors • Self-closing, double-door access • Exhaust air not recirculated • Negative airflow into laboratory
4	Dangerous/exotic agents which pose high risk of life-threatening disease	BSL-3 practices plus: • Clothing change before entering • Shower on exit • All material decontaminated on exit from facility	Primary barriers: • All procedures conducted in Class III BSCs or Class I or II BSCs in combination with full-body, air-supplied, positive pressure personnel suit	BSL-3 plus: • Separate building or isolated zone • Dedicated supply and exhaust, vacuum, and decontamination systems

\*Source: adapted from the BMBL 5th Ed., 2007.

<https://www.cdc.gov/biosafety/>

<http://www.cdc.gov/ncezid/>

<http://www.aaalac.org/resources/theguide.cfm>

[https://www.aaalac.org/accreditation/RefResources/OHS\\_Care\\_And\\_Use.pdf](https://www.aaalac.org/accreditation/RefResources/OHS_Care_And_Use.pdf)

<https://www.osha.gov/SLTC/laboratories/>

<http://www.fda.gov/RegulatoryInformation/Legislation/ucm148797.htm>

<http://cid.oxfordjournals.org/content/35/10/1191.full>

### International Travel

International travel has become more common for employment, recreation, education, and medical missions. Employees should be evaluated and educated in advance of travel regarding health risks. Discussion of diseases typically encountered in the developing world, their prevention and treatment can be found on the CDC web site. Post-travel evaluation and/or testing should be performed as necessary, particularly if illness has occurred during or after travel. Health care workers who will carry out clinical work in HIV-endemic areas of the world without ready availability of antiretroviral medications should be provided with an initial supply of antiretroviral medications and a method to access sufficient medications for a full 28-day course in the event of bloodborne exposure from an HIV-positive source patient.

Institutions that send health care workers to areas of the world where extensively drug-resistant tuberculosis (XDR TB) is present, and where existing infection control measures have not been shown to adequately control transmissions, may consider use of BCG vaccination. Institutions which make BCG vaccination available to health care workers traveling to such environments should make clear that the vaccine has been associated with varying levels of protection, protection is by no means complete, and all other infection control measures must continue to be assiduously followed. Due to its interference with tuberculin skin testing, tuberculosis surveillance among recent BCG recipients must be carried out using an IGRA.

<http://wwwnc.cdc.gov/travel/>

<http://wwwnc.cdc.gov/travel/destinations/list>

<http://wwwnc.cdc.gov/travel/page/presentations-health-pros>

<http://wwwnc.cdc.gov/eid/>

## PHYSICAL HAZARDS

Physical hazards commonly found in health care facilities include electrical hazards, noise, slipping/tripping/falling hazards, heat, poor lighting, inadequate ventilation, and working with medical equipment such as lasers and x-ray equipment. Occupational health services should support the development of a comprehensive safety program. The program should include medical surveillance activities, environmental surveillance reports, safety reviews, incidents reports, and review in promotion of safe work practices.

Physical hazards include direct or repetitive trauma, electrocution, ionizing radiation, non-ionizing radiation (lasers), noise, asphyxiation in confined spaces, and heat and cold stresses resulting from ambient weather or from heating, ventilation, and air conditioning problems. Many health care worksites have typical industrial exposure hazards associated with shop activities, plumbing, heating/cooling, electric, carpentry tasks, laundry, and housekeeping. Where indicated, surveillance may be necessary for repetitive motion/cumulative trauma disorders, shop safety, vision and hearing protection, and instruction in compliance in the use of personal protective equipment. Health care institutions should develop safety programs that incorporate OSHA standards, corporate policies, and best practice guidelines. They should encourage compliance as part of their "corporate culture." These programs should include medical surveillance activities, environmental surveillance reports and review, safety reviews, review of incident reports and mechanisms for employees to report hazardous activities and participate in the development of solutions.

<https://www.osha.gov/SLTC/etools/hospital/hazards/hazards.html>

### Ionizing Radiation:

Ionizing radiation is frequently used in medical care, typically in the form of X-rays or ingested or injected radioisotopes. Exposure to ionizing radiation can cause acute and/or chronic health effects and these effects are proportional to dose and length of exposures. Acute extremely high exposures (not typically experienced in medical center settings) can cause radiation sickness, while lower level chronic exposures cause cell damage that can potentially lead to cancer, other genetic mutations, or cataracts. For this reason, monitoring exposures in health care settings is important.

Because there is a dose-response relationship between ionizing radiation and health effects, there are exposure limits in place. Exposure is measured in milliSieverts (mSv) or millirems (mrem), and annual occupational exposure limits are as follows:

Category	Annual Limit
Deep Dose (whole body) equivalent (DDE)	50 mSv (5000 mrem)
Lens of eye dose equivalent (LDE)	150 mSv (15,000 mrem)
Shallow dose equivalent to skin of whole body or skin of extremity (SDE)	500 mSv (50,000 mrem)
Sum of DDE + individual organ/tissue exposure	500 mSv (50,000 mrem)

The annual exposure limit to a fetus during the entire gestational period is 10% of the DDE – or 5 mSv (500 mrem). Institutions should have a Declared Pregnant Worker policy in place, which allows a woman with occupational radiation exposure to *voluntarily* inform her employer of pregnancy and estimated date of conception, so that she can be monitored in accordance with the lower radiation exposure limits set for pregnancy.

Programs should comply with this and all other federal and state regulations regarding ionizing radiation. A radiation safety committee, including personnel from occupational health, radiology, environmental health/safety, nuclear medicine, surgery, and physical plant, should be in place and active. Monitoring program results should be reviewed, contingency plans (endorsed by leadership) in the event of elevated exposure levels should be available, and incidents (such as radioisotope spills or other unintentional exposures) reviewed and controls put in place to minimize exposure potential.

<http://www.nrc.gov/reading-rm/doc-collections/cfr/part020/full-text.html>

<http://www.osha.gov/SLTC/radiation/index.html>

<http://www.who.int/mediacentre/factsheets/fs371/en/>

<http://ehs.columbia.edu/SafeUseOfRadiopharmaceuticals.html>

### Nonionizing Radiation:

Nonionizing radiation encompasses (in order of decreasing wavelengths) radiofrequency radiation, (including microwaves), infrared radiation, visible light radiation, and ultraviolet radiation. Injuries as a result of nonionizing radiation exposure are primarily thermal or photochemical in nature with the eye and skin most susceptible. Programs should comply with federal and state regulations regarding non-ionizing radiation, and should have a radiation safety committee in place that includes personnel from occupational health, radiology, surgery, environmental health and safety, and physical plant, as well as any other appropriate stakeholders. One of the primary sources of non-ionizing radiation in the medical center setting is laser radiation (see below).

[https://www.osha.gov/SLTC/radiation\\_nonionizing/index.html](https://www.osha.gov/SLTC/radiation_nonionizing/index.html)

**Laser Safety:**

The growing use of lasers in both inpatient and ambulatory settings for procedures as varied as tattoo removal, cautery of infectious lesions, and eye surgery has increased the need for comprehensive laser safety programs. ANSI standard Z 136.3 (2011) addresses a number of safety and specific medical issues pertinent to laser use. Lasers can be UV, infrared, or visible wavelengths and health effects are typically thermal in nature, with eye and skin damage being most commonly encountered. Class 3b and 4 lasers are primarily of concern, as these lasers have a higher risk of ocular and/or skin damage, as well as (in the case of Class 4 lasers) being a fire hazard. Even reflected laser exposure can cause eye damage in the case of class 3b and 4 lasers. Individuals working with these lasers are recommended by ANSI to undergo a baseline ophthalmology history and screening exam. This may include use of precise visual acuity testing, color vision testing, and the use of Amsler Grid visual field testing. Postexposure evaluations should include repeated performance of the above tests as well as any other indicated testing. Symptoms of ocular laser injury include photophobia, decreased visual fields/acuity, and retinal changes.

Ophthalmology referral should be considered as appropriate. Testing should be repeated at the exit examination. Proper eye protection should be worn and should be provided by the employer. The specific surgical case, including the possibility of exposure to infectious materials, should be taken into consideration in the selection of PPE, and the appropriate use of smoke evacuation systems for the surgical plume should be ensured. A qualified Laser Safety Officer should be involved in any laser program. Proper laser safety training is imperative and administrative and engineering controls should be instituted as appropriate to decrease the likelihood of potential exposures.

[http://www.ast.org/uploadedFiles/Main\\_Site/Content/About\\_Us/Standard%20Laser%20Safety.pdf](http://www.ast.org/uploadedFiles/Main_Site/Content/About_Us/Standard%20Laser%20Safety.pdf)

<https://www.osha.gov/SLTC/laserhazards/index.html>

<https://www.osha.gov/SLTC/laserelectrosurgeryplume/index.html>

<http://www.ehrs.upenn.edu/programs/laser/lasermanual/>

[https://www.osha.gov/SLTC/etools/eyeandface/ppe/light\\_radiation.html#Lasers](https://www.osha.gov/SLTC/etools/eyeandface/ppe/light_radiation.html#Lasers)

**Ergonomics**

Ergonomic issues arise in almost all activities performed in health care facilities. Of particular concern are back and shoulder/neck injuries and repetitive motion/cumulative trauma disorders. Back problems continue to be the leading cause of lost time injuries among health care workers. Recent data suggest that the incidence of musculoskeletal injury is highest among nurse aides and exceeds even the incidence rate of back injury in industrial workers. Cumulative trauma disorders are hazards among clerical workers, laboratory personnel, custodial workers, surgeons of many specialties, and potentially the entire hospital workforce. The occupational health service should work closely with purchasing, administration and safety in the acquisition, implementation and design of facilities and equipment. Involving front-line workers in equipment evaluation and selection represents an important step. Hospital ergonomics programs should include the establishment of ergonomic committees, the systematic evaluation of hazards, either through surveys or through formal process assessment, and the development of written programs. Technology has evolved to the point where minimal lift policies can pay for themselves and increase patient satisfaction. Increasingly, hospitals must include considerations of bariatric patients, i.e., patients "of size," with weights in the range of 500 to 750 pounds.

Safe patient movement and handling programs represent a major change to the patient care process and must be integrated across disciplines, not just nursing but also rehabilitation, imaging, and surgical disciplines. Such programs now require systematic assessment of and identification of high-risk areas, assessment of hazards, equipment selection, training, maintenance, and development of no-lift policies. Use of safe patient handling equipment has been associated with substantial reductions in injuries among acute care hospital personnel. In response, the American Nurses Association has published a standard of care for nurses.

Because of the benefits to patient care and workers, OSHA has recently formed an alliance with the Centers for Medicare and Medicaid Services and enlisted hospital systems in their hospital engagement networks. Similar strategies at CMS led to payment reform considerations, hence hospitals are well advised to implement injury prevention programs to prevent adverse patient and employee outcomes from falls.

<http://www.nursingworld.org/handlewithcare>

<https://www.osha.gov/dsg/hospitals/index.html>

<http://www.osha.gov/ergonomics/guidelines/nursinghome/index.html>

<http://www.cdc.gov/niosh/topics/ergonomics/>

<http://www.cdc.gov/niosh/docs/wp-solutions/2006-148/>

<http://www.cdc.gov/niosh/docs/2006-117/>

**Slips, Trips, and Falls:**

Slips, trips, and falls (STFs) are one of the most common injury types experienced by health care workers, with sprains, strains, and contusions leading the list of injuries sustained. STFs are also the second-leading cause of lost work time, which impacts both the injured employee and the patients for whom they care (not to mention the institution itself). A wide variety of circumstances can contribute to the risk of STFs, including water and other fluids on the floors, surface irregularities, ice and snow, clutter and other trip hazards, and poor lighting. Understanding what the risks are, where they are most likely to occur, and developing processes to prevent the injuries from occurring are all parts of a comprehensive strategy to combat STFs. All stakeholders should be included, and a comprehensive program to address STFs – one that considers such factors as proper hazard evaluation and communication, hazard remediation, and implementation of control measures for prevention, as well as efficient written reporting procedures -- is important in minimizing both the occurrence and the impact of STFs.

<http://www.cdc.gov/niosh/docs/2011-123/pdfs/2011-123.pdf>

<https://www.osha.gov/SLTC/etools/hospital/hazards/slips/slips.html>

**CHEMICAL HAZARDS**

Health care workers may be exposed to a wide variety of potentially toxic chemicals (Table 7). Exposures can occur either during unexpected incidents or during normal working conditions. The effects may range from minor skin irritation to chronic disease (e.g. occupational asthma), adverse reproductive outcomes or possible mutagenic effects. Exposures may trigger acute attacks of asthma either in workers who were previously sensitized or through their irritating properties. The occupational health service (OHS) should have access to clinical toxicology, appropriate industrial hygiene monitoring, environmental control methodology, and recommended and/or regulatory exposure levels. Safety Data Sheets (SDS), computerized databases and poison control centers (1-800-222-1222) may be helpful in obtaining information regarding chemical exposures. Useful resources include the following:

**Table 7. Selected Chemicals in Hospitals**

	Central Sterile	Diagnostic Imaging	Food Service	Home Health	House-keeping	Laboratory	Laundry	Patient Care Med/Surg	Pharmacy	Plant Operations	Surgical Service	Therapeutic Radiology
Allergic sensitization						X		X			X	
Ammonia			X		X							
Antibiotics			X					X	X		X	
Asbestos										X		
Boiler ash and scale										X		
Cadmium												X
Caustics			X		X					X		
Chlorine, bleach			X		X		X					
Concentrated acids and bases					X		X		X			
Cryogenic liquids						X						
Cytotoxics				X				X	X		X	
Disinfectants, cleaners	X		X		X	X	X	X	X	X	X	
Drain/oven cleaners			X		X							
Ethylene oxide	X											
Formaldehyde								X			X	
Glutaraldehyde								X			X	
Hazardous waste				X		X		X			X	
Isopropanol								X			X	
Latex		X	X		X	X	X	X	X		X	
Lead												X
Mercury								X			X	
Old chemicals					X	X				X		
Paints, glues										X		
Photochemicals		X										
Preservatives and fixatives						X						
Radioisotopes		X				X						

Ribavirin								X	X			
Solvents				X	X				X	X		
Surgical smoke											X	
Waste anesthetic gases											X	
Welding/solder fumes										X		

OSHA publishes a [summary](#) of its standards concerning chemical hazards encountered in health care settings. The [OSHA Occupational Chemical Database](#) compiles information from several government agencies and organizations and includes information on physical properties, exposure guidelines, the National Institute of Occupational Safety and Health (NIOSH) Pocket Guide, and emergency response information, including the Department of Transportation Emergency Response Guide. The [OSHA Chemical Sampling Information Database](#) presents, in concise form, data on a large number of chemical substances that may be encountered. OSHA also provides information on [carcinogen-related OSHA standards](#), hazard recognition, exposure evaluation, possible solutions and training.

The [Agency for Toxic Substances and Disease Registry](#) developed [Medical Management Guidelines \(MMGs\) for Acute Chemical Exposures](#) to aid in emergency medical response to chemical incidents. It provides basic chemical and exposure information, a summary of potential health effects, pre-hospital management information, emergency department management information, and information for the patient. It is part of the guide [Managing Hazardous Materials Incidents](#).

The [NIOSH Pocket Guide to Chemical Hazards](#) presents key information and data in abbreviated or tabular form for several hundred chemicals and substance groupings found in the work environment. In addition, [NIOSH has specific occupational health guidelines](#) for many chemical hazards.

The National Library of Medicine [Toxicology Data Network](#), also known as Toxnet, maintains an accessible database on toxicology, hazardous chemicals, environmental health and toxic releases.

Many states have passed “Right to Know” (RTK) legislation requiring worker education about hazardous substances. For example, the New Jersey Department of Health [RTK Program](#) has an extensive database of chemical fact sheets.

The New York State Nurses Association and the Mount Sinai School of Medicine Irving J. Selikoff Center for Occupational and Environmental Medicine published a monograph in *New Solutions: A Journal of Environmental and Occupational Health Policy*, on [Controlling Health Hazards to Hospital Workers](#) in 2013. It provides a comprehensive review of exposure control methods for more than 30 hazards in the hospital setting and of internet resources to address them.

The American Conference of Governmental Industrial Hygienists (ACGIH) publishes annual editions of the Threshold Limit Value (TLV) [occupational exposure guidelines](#) for more than 700 chemical substances and physical agents and more than 50 biological exposure indices (BEIs), as well as work practice guides.

Because employee knowledge of hazards and safe work habits is essential to prevent occupational diseases, each workplace should develop educational policies to ensure that workers are familiar with potential hazards and encourage workers to follow safe work practices. OSHA’s revised [Hazard Communication Standard](#) (CFR 1919.1200), now aligned with international standards, requires employers to make employees aware of hazards to which they may be exposed.

SDS should be readily available at the worksite as well as at the OHS. Hazard information should be communicated through a written hazard communication program, formal training programs, and labeling. Employee training should encompass the following:

- How to access and utilize available hazard information, to include reading and interpreting labels and MSDS.
- Identification and characteristics of hazards present at the worksite;
- Employee protection plan detailing the use of personal protective equipment, safe work practices, and engineering controls. Proper glove and respirator selection should be stressed.

Proper emergency procedures must be developed and effective safety and personal protective equipment made available. If respirators are required, OHS should ensure that workers are medically evaluated appropriately prior to respirator fit testing and use. The OHS should obtain the same information as contained in mandatory [Appendix C](#) of the standard. An annual review of the employee’s medical status is not required.

Table 8 summarizes OSHA-mandated medical screening and surveillance requirements based on exposure. Preplacement and periodic exams are dependent upon specific factors cited in the standard such as airborne concentrations of the substance and/or years of exposure, biological indices, age of the employee and amount of time exposed per year. In addition, some of standards require periodic exams to be conducted at varying time intervals. Refer to the standards for complete details.

**Table 8. OSHA Mandated Medical Screening and Surveillance Requirements Based on Exposure**

Exposure/ Chemical	OSHA Standard	Preplacement	Periodic	Emergency/Exposure	Termination
Asbestos	1910.1001(l)	Yes		No	Yes
Cadmium	1910.1027(l), 1926.1127, 1915.1027	Yes			
Carcinogen (Suspect)	1910.1003-1016(g), 1926.1103	Yes			No
Ethylene Oxide	1910.1047(i)	Yes			
Formaldehyde	1910.1048(l), 1926.1148	Yes			
Hazwoper*	1910.120(f)	Yes			
Hazardous Lab Chemical	1910.1450(g)	If required by other standards		Yes	No
Lead	1910.1025(j)	Yes			No
Noise	1910.95(g)	Audiometric		No	Audiometric
Respiratory (Protection)	1910.134(e)	Yes	If required	No	

\*Hazardous Waste Operations and Emergency Response

Many useful apps concerning chemical and other hazards for mobile access through smart phones have also been developed. Some free examples include Wisier, Mobile REMM, and Health Hotlines.

<https://www.osha.gov/SLTC/healthcarefacilities/otherhazards.html>

<https://www.osha.gov/chemicaldata/>

[https://www.osha.gov/dts/chemicalsampling/toc/toc\\_chemsamp.html](https://www.osha.gov/dts/chemicalsampling/toc/toc_chemsamp.html)

<https://www.osha.gov/SLTC/carcinogens/index.html>

<http://www.atsdr.cdc.gov/>

<http://www.atsdr.cdc.gov/MMG/index.asp>

<http://www.atsdr.cdc.gov/MHMI/index.asp> <http://www.cdc.gov/niosh/npg/>

<http://www.cdc.gov/niosh/docs/81-123/>

<https://toxnet.nlm.nih.gov/>

<http://www.state.nj.us/health/workplacehealthandsafety/right-to-know/>

[https://www.ona.org/documents/File/healthandsafety/NYSNU\\_ControllingHealthHazardsHospitalWorkersReference\\_2013.pdf](https://www.ona.org/documents/File/healthandsafety/NYSNU_ControllingHealthHazardsHospitalWorkersReference_2013.pdf)

<http://www.acgih.org/sitemap>

[https://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=TESTIMONIES&p\\_id=349](https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=TESTIMONIES&p_id=349)

[https://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9783](https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9783)

### Specific Chemical Exposures:

#### **Anesthetic Gases**

According to NIOSH, exposure to high concentrations of waste anesthetic gases, even for a short time, may cause the following health effects: headache, irritability, fatigue, nausea, drowsiness, difficulties with judgment and coordination, and liver and kidney disease. Some studies report possible adverse effects among personnel exposed to low concentrations of waste anesthetic gases over long time periods that include hepatotoxicity, reproductive harm, including spontaneous termination of pregnancy, cancer and perceptual, cognitive and motor skill impairment. Other studies report no adverse health effects from long-term exposure to low concentrations of waste anesthetic gases. Studies have also reported spontaneous miscarriages in the spouses of exposed workers and birth defects in their offspring.

Meticulous attention to safe work practices and proper use and maintenance of mandated anesthetic gas scavenging systems reduce the potential for exposure. Area and personal monitoring may be necessary to assure adequate control. Room ventilation turnover and local exhaust ventilation should meet mandated guidelines. Equipment should be checked routinely for trace anesthetic gas levels. However, OSHA standards do not specifically address waste anesthetic gases. OSHA has published guidelines for [workplace exposures](#) and for [waste recognition and possible solutions](#). NIOSH has published a guide on waste anesthetic gases [occupational hazards in hospitals](#).

<https://www.osha.gov/dts/osta/anestheticgases/index.html>

<https://www.osha.gov/SLTC/wasteanestheticgases/index.html>

<http://www.cdc.gov/niosh/docs/2007-151/>

**Asbestos**

OSHA requires medical surveillance and recordkeeping for workers with current exposure. Although controversial, OSHA regulations do not require ongoing medical surveillance once the hazard has been remediated. Asbestos is still frequently encountered during routine maintenance activities, renovation projects and demolition for new construction. Only those with specialized training, working in a sealed environment using appropriate personal protective equipment should be involved in asbestos mitigation. In medical center environments, this is generally handled via outside contractual services. Periodic air sampling is required to document the exposure level. Regulations guiding the removal and management of asbestos have been issued by both OSHA and the U.S. Environmental Protection Agency (EPA).

OSHA has published an [overview of asbestos](#) and has issued the [asbestos standard](#), which includes mandatory medical questionnaires (Appendix D) and interpretation and classification criteria for chest roentgenograms (Appendix E) and non-mandatory guidelines for medical surveillance (Appendix H). NIOSH has published [resources on asbestos](#).

<https://www.osha.gov/SLTC/asbestos/index.html>

[https://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9995](https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9995)

<http://www.cdc.gov/niosh/topics/asbestos/>

**Disinfectants**

Exposure to disinfectants and cleaning solutions is a common cause of chemical injuries among medical center employees, with housekeepers and maintenance workers at greatest risk. Glutaraldehyde irritates skin and mucous membranes and may cause allergic contact dermatitis, rhinitis and asthma. Perchloracetic acid causes similar problems. Bleach is an irritant and, in high concentrations, may cause burns of the skin, mucous membranes and eyes. The use of soaps in handwashing is a common cause of skin irritation and less commonly contact dermatitis among nursing and medical staff. The Centers for Disease Control and Prevention (CDC) [guidelines on handwashing](#) emphasize the use of disinfectants and skin protecting lotions to prevent irritant contact dermatitis. Regulatory inventory review is necessary for proper product control and safety. CDC has also published guidelines for [disinfection and sterilization in health care facilities](#), [infection control in dental health care settings](#) and [environmental infection control in health care facilities](#).

<http://www.cdc.gov/handwashing/>

[http://www.cdc.gov/hicpac/pdf/guidelines/Disinfection\\_Nov\\_2008.pdf](http://www.cdc.gov/hicpac/pdf/guidelines/Disinfection_Nov_2008.pdf)

<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5210a1.htm>

**Ethylene oxide**

Ethylene oxide is a colorless gas used to sterilize temperature-sensitive medical instruments. It has a distinctive sweet odor, but the average odor threshold is relatively high. Ethylene oxide is regulated by OSHA as a carcinogen. Medical surveillance is required for employees with exposure over the action level of 0.5 ppm time-weighted average. The OSHA permissible exposure level is 1.0 ppm. The area of highest exposure risk is in central sterilization areas. Risk reduction requires engineering controls and continuous or periodic air monitoring, preferably with an alarm system, as well as good work practices. Instruments sterilized with ethylene oxide must be aerated in aeration cabinets before they are used. Ethylene oxide exposure most commonly occurs via dermal absorption or inhalation so appropriate personal protective equipment is indicated. Medical surveillance may also be indicated in light of the known association of ethylene oxide with increased spontaneous abortions, mutagenicity, carcinogenicity (stomach, leukemia and other hematopoietic cancers) and neurotoxicity at higher exposure levels. It is unclear whether lower level exposure settings need ongoing medical surveillance. If done, surveillance should focus on the hematopoietic, reproductive, renal and nervous systems. OSHA has published standards, hazard recognition, exposure evaluation and possible solutions concerning [ethylene oxide](#).

<https://www.osha.gov/SLTC/ethyleneoxide/index.html>

**Formaldehyde**

Formaldehyde is a human carcinogen which also causes dermal and mucosal irritation, sensitization and inflammation. Exposure risk areas include autopsy rooms, pathology laboratories and dialysis units. Exposure also occurs in endoscopy and surgical facilities. If the action level of 0.5 ppm time-weighted average is exceeded, preplacement and periodic examinations should include pulmonary, dermal and hepatic evaluations. The employer must make medical surveillance available for employees who develop signs and symptoms of overexposure to formaldehyde and for all employees exposed to formaldehyde in emergencies. Personal protective equipment, including appropriate gloves, and spill absorbent materials should be available in areas where spills are likely. Odor is not a reliable warning for the presence of formaldehyde, because the ability to smell formaldehyde is quickly extinguished.

OSHA has published standards, hazard recognition, exposure evaluation and possible solutions concerning [formaldehyde](#). NIOSH has published resources on [formaldehyde](#).

<https://www.osha.gov/SLTC/formaldehyde/index.html>

<http://www.cdc.gov/niosh/topics/formaldehyde/>

### **Glutaraldehyde**

Glutaraldehyde is a commonly used solution for both disinfection and sterilization. Absorption may occur by inhalation, dermal contact or ingestion. Environmental monitoring, adequate ventilation and skin protection are necessary to prevent health problems. Allergic dermatitis, mucous membrane irritation, and occupational asthma have been reported. Glutaraldehyde also has been associated with fetotoxicity in laboratory mice. Glutaraldehyde solutions must be dated so that proper exchange of the solution can occur before it loses its bactericidal effectiveness.

OSHA has published tools to address the health care potential hazards, health effects and possible solutions concerning [glutaraldehyde](#) and best practices for the safe use of [glutaraldehyde in health care](#). NIOSH has published resources on [glutaraldehyde](#).

<https://www.osha.gov/SLTC/etools/hospital/hazards/glutaraldehyde/glut.html>

<https://www.osha.gov/Publications/glutaraldehyde.pdf>

<http://www.cdc.gov/niosh/topics/glutaraldehyde/>

### **Hazardous Drugs**

Many pharmaceutical agents have been reported to be carcinogenic, mutagenic, or teratogenic in animal studies and limited human studies. Studies of occupational exposures have shown detectable levels of fugitive antineoplastic and other medications, such as pentamidine and ribavirin, in the air of hospital pharmacies with no ventilation hoods, and in patient rooms with no environmental control measures. Trace quantities also have been demonstrated in facilities with appropriate engineering controls and reported use of safety practices. Pharmacy personnel and nurses working with chemotherapeutic drugs have been reported to have increased sister chromatid exchanges, chromosomal gaps and mutagenic agents in their urine. Women who work with antineoplastic agents have reported increased infertility, spontaneous terminations of pregnancy and congenital malformations in their offspring. Although nurses and pharmacists are particularly susceptible to exposure to antineoplastic agents, potential exposure to other employees, such as housekeepers handling contaminated linens, should not be overlooked.

Each institution should develop policies consistent with OSHA guidelines designed to ensure the safety of personnel dealing with cytotoxic (antineoplastic) and other hazardous drugs. Education and strict adherence to good technique are necessary to limit exposure. Pharmacists should use vertical exhaust hoods and wear appropriate personal protective equipment. Nursing staff must practice meticulous technique to avoid spills, leaks and accidental needlestick injuries. Both skin absorption and inhalation exposure can be limited in these ways. Employees should be encouraged to report known or suspected breaches in protection or inadvertent exposures, which warrant immediate evaluation and follow-up with a higher likelihood of measurable injury or disease than would result from periodic testing.

NIOSH and OSHA recommend that personnel involved with preparation and administration of antineoplastics should be included in medical monitoring programs focusing on hematologic and reproductive systems, but this is an area of controversy. NIOSH recommends that medical surveillance includes:

- Baseline and periodic reproductive and general health questionnaires.
- Baseline and periodic complete blood count and urinalysis. Liver function and transaminase tests may be considered.
- Baseline physical examination and then as needed for any worker whose health questionnaire or lab tests indicate an abnormal finding.
- Follow-up for a worker who has health changes or with a significant exposure.
- Monitoring for trends that may be a sign of health changes because of exposure to hazardous drugs. If health changes are found, the employer should evaluate current protective measures, develop a plan of action to prevent further employee exposure, confidential notification of the exposed worker and offer alternative duty or temporary reassignment.

NIOSH recently released the [NIOSH List of Antineoplastic and Other Hazardous Drugs in Healthcare Settings, 2016](#), DHHS (NIOSH) Publication No. 2016-161. It is the latest version of a list first published by NIOSH in 2004 as an appendix to the Alert about antineoplastic and other hazardous drugs used in health care settings. Hazardous drugs include those used for cancer chemotherapy, antiviral drugs, hormones and some bioengineered drugs, as well as others drugs. This list categorizes drugs into 3 groups: 1) 115 antineoplastic drugs; 2) 53 non-antineoplastic hazardous drugs; and 3) 49 drugs with reproductive effects. It includes 34 drugs not found on previous lists and general guidance on engineering controls and personal protective equipment for various activities that may be encountered in health care settings.

OSHA has published standards, hazard recognition and possible solutions concerning [hazardous drugs](#) and a [technical manual](#) on controlling occupational exposure to hazardous drugs (section VI, chapter 6).

NIOSH has published resources on [hazardous drug exposures in health care](#), [occupational exposure to antineoplastic agents](#), and [medical surveillance](#) and [prevention](#) concerning occupational exposure to antineoplastic and other hazardous drugs in health care settings, and a list of antineoplastic and hazardous drugs in health care settings.

Accrediting bodies require enforcement of [standards](#) for health care organizations to encourage the development of comprehensive safety programs, including those related to the environment of care and infection control programs.

[Washington](#) and [California](#), have adopted the NIOSH recommendations on hazardous drug exposures as state regulations.

The American Society of Clinical Oncology and the Oncology Nursing Society issued [Chemotherapy Administration Safety Standards](#) in 2013, which is a consensus-based approach to safe handling of chemotherapy.

[http://www.cdc.gov/niosh/topics/antineoplastic/pdf/hazardous-drugs-list\\_2016-161.pdf](http://www.cdc.gov/niosh/topics/antineoplastic/pdf/hazardous-drugs-list_2016-161.pdf)

<https://www.osha.gov/SLTC/hazardousdrugs/index.html>

[https://www.osha.gov/dts/osta/otm/otm\\_vi/otm\\_vi\\_2.html](https://www.osha.gov/dts/osta/otm/otm_vi/otm_vi_2.html)

<http://www.cdc.gov/niosh/docs/wp-solutions/2013-103/pdfs/2013-103.pdf>

<http://www.cdc.gov/niosh/docs/2004-165/>

<http://www.jointcommission.org/assets/1/18/TJC-ImprovingPatientAndWorkerSafety-Monograph.pdf>

<http://www.lni.wa.gov/Safety/Topics/AtoZ/HazardousDrugs/>

[http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201320140AB1202](http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140AB1202)

<https://www.ons.org/sites/default/files/2013chemostandards.pdf>

### **Latex Hypersensitivity**

Allergic responses to latex materials have been identified as a substantial issue for health care providers and their patients. The response is varied and may rarely be fatal. The delayed hypersensitivity reaction (Type IV) appears as an eczematous local contact allergic dermatitis. It is usually not due to latex itself but primarily to chemicals added to accelerate curing of rubber during glove manufacturing. Immediate hypersensitivity (Type I) is a local and systemic allergic response to natural rubber latex protein that is associated with rapid onset of urticaria, which may progress to rhinitis, respiratory symptoms, angioedema or asthma. Exposure leading to these symptoms may occur by direct contact or by inhalation of aerosolized latex. Latex dust may be difficult to eliminate once it has permeated carpeting, furniture and ductwork. Immediate hypersensitivity responses are mediated by IgE, and may be diagnosed with serum IgE radioallergosorbent testing (RAST) or under carefully monitored circumstances skin prick testing with natural latex. Information about latex allergy should be disseminated to health care employees, students, ancillary personnel and patients. Facilities should identify latex containing products, such as gloves, condoms, catheters, balloons, tourniquets, anesthesia equipment, airways and respirator bellows. Appropriate evaluation, restrictions and reasonable accommodations, if indicated, should be provided to potentially affected employee. The evaluation should include other agents that may also cause asthma in health care workers.

A latex allergy policy can facilitate the proper establishment of latex safe environments to meet the needs of patients and employees. This policy should address purchasing, education, latex safe areas and signage, as well as patient care issues. The major latex reduction methods to consider are conversion to powder-free latex gloves, which significantly reduce latex aerosolization, or conversion to non-latex gloves.

OSHA has published standards, hazard recognition and possible solutions concerning [latex allergy](#). NIOSH has published resources on [occupational latex allergy](#).

<https://www.osha.gov/SLTC/latexallergy/index.html>

<http://www.cdc.gov/niosh/topics/latex/>

### **Lead and Cadmium**

Alloys containing lead and cadmium are frequently encountered in cancer radiation therapy centers. Although these compounds generally present little in the way of fume hazards, processes such as grinding and filing may introduce lead and cadmium dust into the working environment. Proper work hygiene is essential to minimize the potential hazards. There are OSHA medical surveillance guidelines covering lead and cadmium for workers exposed above certain levels. OSHA has published standards, health effects, exposure evaluation and possible solutions concerning [lead](#) and [cadmium](#). NIOSH has published training and medical guidelines concerning [lead](#) and resources concerning [cadmium](#).

<https://www.osha.gov/SLTC/lead/index.html>

<https://www.osha.gov/SLTC/cadmium/index.html>

<http://www.cdc.gov/niosh/topics/lead/medical.html>

<http://www.cdc.gov/niosh/topics/cadmium/>

### **Mercury**

Mercury may be present in some laboratories and physical plant instruments and switches. It may also be present in gastrointestinal equipment and supplies, blood pressure measurement devices/sphygmomanometers, thermometers, plumbing systems, batteries and fluorescent bulbs. Laboratory fixatives and reagents should be certified mercury-free. Many chemical analyses report no mercury at the lowest concentration detectable; in these cases the detection limit should be specified. When a health care facility continues to use mercury-containing devices, physical plant and safety personnel must remain knowledgeable regarding the cleanup of spills. Personnel should receive training in the hazard of mercury exposure and the importance of reporting spills promptly. Personnel involved in the cleanup of spills should be trained and use respirator and appropriate personal protective equipment. Safe and accurate substitutes for mercury thermometers and blood-pressure devices do exist. EPA and the American Hospital Association have a [memorandum of understanding](#) which seeks to eliminate mercury from the hospital waste system. NIOSH and OSHA have published an occupational health guideline for [inorganic mercury](#).

<https://www3.epa.gov/region09/waste/p2/projects/hospital/mercury.pdf>

<http://www.cdc.gov/niosh/docs/81-123/pdfs/0383.pdf>

### **Methyl Methacrylate and other Glues, Cements and Bonding Materials**

Methyl methacrylate is an acrylic substance used as a cement for dental and orthopedic implants. It is compounded by mixing a powder and liquids which are provided separately. Methyl methacrylate has been associated with mucous membrane irritation and headache in operating room personnel. It is known to cause both allergic dermatitis and asthma. Degenerative liver changes have been reported in animals. Exhaust ventilation from the site of use and mixing in a closed container with attached exhaust are instrumental in limiting exposure. Some acrylics now undergo ultraviolet curing. This has been reportedly associated with a photosensitization hazard, though poorly described. OSHA has published resources on [methyl methacrylate](#).

[https://www.osha.gov/dts/chemicalsampling/data/CH\\_254400.html](https://www.osha.gov/dts/chemicalsampling/data/CH_254400.html)

### **Nitric Oxide**

Nitric oxide is used as a vasodilator in the treatment of hypoxic respiratory failure in full- and near-term infants. It is a colorless, essentially odorless gas with a very narrow therapeutic window for patients. Acute exposure effects include mucous membrane irritation and drowsiness. More serious effects include methemoglobinemia, delayed pulmonary toxicity and damage and central nervous system effects. Exposed employees may be relatively asymptomatic at the time of exposure and take as long as 72 hours to manifest clinical symptoms. OSHA classifies nitric oxide as a highly hazardous substance. OSHA has published resources on [nitric oxide](#). NIOSH has published [recommendations](#) and [guidance](#) on nitric oxide.

[https://www.osha.gov/dts/chemicalsampling/data/CH\\_256700.html](https://www.osha.gov/dts/chemicalsampling/data/CH_256700.html)

<http://www.cdc.gov/niosh/topics/nitric-acid/>

<http://www.cdc.gov/niosh/docs/81-123/pdfs/0447.pdf>

### **Surgical Smoke**

Surgical smoke or plume consists of the aerosolized contaminants emitted during the use of electrosurgical instruments, devices emitting laser beams and other equipment generating smoke through the cauterization, destruction or vaporization of tissue during a procedure. Surgical smoke contains hazardous particles, including respiratory irritants, carcinogens, blood fragments and lung-damaging dusts, and has been linked to asthma and infectious agents, such as human papilloma virus. OSHA has published resources on [laser/electrosurgery plumes](#). NIOSH has published [recommendations](#) on the control of smoke from laser and electric surgical products.

<https://www.osha.gov/SLTC/laserelectrosurgeryplume/index.html>

<http://www.cdc.gov/niosh/docs/hazardcontrol/hc11.html>

## **HAZARDS RELATED TO THE GENERAL MEDICAL CENTER ENVIRONMENT**

### *Environmental Surveillance and Control*

Because health care workers may be exposed to a number of potential hazards, the environmental control program must be able to identify potential hazards, evaluate the nature and extent of the exposure and recommend effective control measures. Specific training and policies should meet OSHA, EPA, CDC, and other governmental requirements and guidelines.

Areas of particular concern include:

- 1) Ventilation, including routine inspection and servicing of laminar flow hoods, heating, ventilation, air conditioning, and humidification units, etc.
- 2) Confined space entry.
- 3) Medical waste management and disposal.
- 4) Electromagnetic radiation and radioisotopes.
- 5) 5) Ergonomic issues, including selection and modification of office equipment, lifts and hoists, etc.
- 6) Proper hygiene practices around chemical substances.
- 7) Proper procedures where exposures to blood or body fluids may occur.
- 8) Noise exposure.

#### *Waste management*

Waste management, while costly, impacts the health of employees, patients and visitors. It may also result in regulatory violations and fines. Although a full discussion of this topic is outside the scope of this document, minimizing harm to the environment is an important issue. There are also direct and obvious benefits to employees: reducing the amount of waste that has to be collected and treated as hazardous or infectious, which reduces risk of employee exposure as well as decreases the frequency and intensity of lifting and sorting waste. Goals of effective waste management include reduced environmental impact, increased patient safety, increased patient confidentiality, decreased operating costs, enhanced public image for health care and improved employee morale.

<http://www.noharm.org/>

<http://www.epa.gov/oppt/library/pubs/archive/acct-archive/pubs/hospitalreport.pdf>

#### *Reproductive hazards*

Many work assignments in a hospital setting entail potential exposures of special concern to pregnant personnel. Infectious exposures, such as cytomegalovirus, parvovirus B19, measles, rubella and others are well established to cause fetal harm among susceptible individuals. Heavy exposures to anesthetic gases and chemotherapeutic agents have also been associated with adverse pregnancy outcomes in some studies. There does not appear to be adequate evidence for adverse pregnancy outcomes among pregnant personnel exposed to MRI, nitric oxide, or among those who work under present-day conditions as x-ray technicians. Currently applicable CDC infection control guidelines for infectious agents, NIOSH and OSHA procedural guidelines for handling chemical agents, and OSHA and NRC standards for monitoring and managing radiation exposure are protective of pregnant personnel, and must be strictly enforced.

For most chemical, physical, and infectious hazards in the health care workplace, existing safety programs provide the necessary training, work practices, engineering controls, and personal protective equipment to adequately protect all workers, regardless of pregnancy status. Given the additional teratogenic risks of hazardous medications such as chemotherapeutic agents and the antiviral agent ribavirin, institutions may wish to allow pregnant women to request reassignment from handling these highly teratogenic agents. Viruses of special concern to pregnant women include cytomegalovirus, parvovirus B19, rubella, toxoplasmosis, herpes simplex, measles, varicella zoster, and emerging pathogens such as Ebola and Zika.

**Cytomegalovirus (CMV)** infection during pregnancy may be associated with hearing loss in the newborn or with the congenital CMV syndrome, which may affect multiple organ systems. CMV may be shed by CMV-infected infants or children, or by CMV-infected immunocompromised patients. Studies have shown, however, that the rate of primary CMV infection among those who care for such patients is no higher than the rate among those without such patient contact. Studies in areas with a high CMV prevalence among patients have also shown that health care workers do not have higher CMV transmission rates than non-health care workers. Although most fetal infections follow primary infection of the mother, some fetal infections have occurred following reactivation of old infection in the mother or reinfection of the mother. As transmission requires direct contact with infectious fluids, adherence to handwashing and to standard precautions is protective for pregnant health care workers caring for CMV-infected patients. The CDC recommends **against** excluding pregnant women from providing care to patients with CMV.

**Herpes simplex (HSV)** infection during pregnancy has been associated with mucocutaneous lesions, sepsis, encephalitis, and rarely congenital malformations. Herpes simplex infection from patient care activities is unlikely. Pregnant personnel caring for patients with HSV infections should adhere to handwashing and standard precautions.

**Measles** exposure during pregnancy has been associated with spontaneous abortion and with prematurity. Measles is transmitted by large droplets and via the airborne route. Measles vaccine is protective, and two doses administered subsequent to the first birthday are considered adequate evidence of immunity. Patients with measles should be cared for by

vaccinated personnel under airborne precautions. All health care personnel born since 1957 should have documented immunity to measles, either via vaccination or a positive rubeola IgG. The occupational health service should be able to readily identify personnel who lack immunity and cannot receive vaccination, as these individuals are at very high risk of acquiring measles if exposed. Non-immune pregnant health care workers should be vaccinated in the postpartum period. Non-immune personnel, regardless of pregnancy status, should not care for patients with measles.

**Rubella** exposure during pregnancy may cause the rubella congenital syndrome, which affects multiple organ systems. Rubella is spread via respiratory droplets, or (in the case of infants with congenital rubella) by contact. Patients with rubella should be cared for by vaccinated personnel under droplet and contact precautions. Women immune to rubella by vaccination are not at risk of adverse events if exposed during pregnancy. All health care personnel should have documented immunity to rubella, either via vaccination or a positive rubella IgG. The occupational health service should be able to readily identify personnel who lack immunity and cannot receive vaccination. Non-immune pregnant health care workers should be vaccinated in the postpartum period. Non-immune pregnant personnel should not care for patients with rubella infection.

**Varicella zoster (VZV)** (the virus which causes chicken pox and herpes zoster) may cause fetal malformations when a non-immune pregnant mother is exposed. VZV is spread by contact or via the airborne route. Patients with chicken pox or with disseminated herpes zoster should be cared for by personnel with established serological immunity using contact and airborne precautions. All health care personnel should have documented immunity to varicella, either through a positive varicella IgG, or two doses of a varicella-containing vaccine. Non-immune pregnant health care workers should be vaccinated in the post-partum period. Non-immune personnel, regardless of pregnancy status, should not care for patients with chicken pox or disseminated herpes zoster.

**Parvovirus B19**, the cause of fifth disease, may cause fetal death if exposure occurs during the first half of pregnancy. Infection is spread by large respiratory droplets and close contact. While rare, transmissions of parvovirus to health care workers have been documented. Droplet precautions must be employed during care of patients with parvovirus infection. CDC does not recommend excluding pregnant women from providing care to patients with parvovirus B19.

<http://www.cdc.gov/hicpac/pdf/InfectControl98.pdf>

<http://www.cdc.gov/cmvrisk/preg-women.html>

<http://www.cdc.gov/parvovirusb19/pregnancy.html>

<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6007a1.htm>

#### *Building Associated Illness/Indoor Air Quality*

Health care facilities must develop an indoor environmental program to ensure a healthy building environment. Central to this mission is the use of ventilation standards, development of good operations and maintenance procedures, establishment of construction and remediation standards and effective management of moisture, mold, and other indoor environmental problems. The American Society for Heating, Refrigerating, and Air conditioning Engineers has published a standard for indoor air quality in hospitals. Hospital ventilation systems are usually far more complex than those of office buildings, hotels, or schools because of the multiple uses and locations, including operating rooms, bone marrow transplant units, and sterilization areas. Systems in hospitals degrade, and construction management requires the development of formal approaches to controlling bioaerosol release in health care. In addition, water intrusion, from construction or systems failure, is not infrequent and requires structured responses. There are important differences between North American indoor air quality (IAQ) standards for infection control and those in the U.K. system, including requirements for vestibules, directional airflow in vestibules, and air quantities.

IAQ complaints must be properly evaluated in a timely fashion. Facilities are generally more successful if they have a defined procedure including ways of reporting complaints, designated responders, and a formal approach to providing feedback. Assessment of individuals and of the environment may occur in parallel but require very different skills. Clinicians should assess staff, patients, or visitors to determine whether symptoms may represent building-related disease or irritant symptoms and differentiate between illness in response to chemical exposures (e.g., off gassing of carpet, tobacco smoke, combustion products), inadequate ventilation, and illness of microbiologic origin. In many situations, psychosocial factors, including job satisfaction and work organization, contribute to the perception of discomfort and disease. The primary environmental assessment generally requires an engineering assessment of the systems and, often, an industrial hygiene assessment of potential sources. In general, quantitative sampling should be limited to the specific contaminants suspected by the environmental and medical assessments, with a very clear justification for sample collection. Detailed reporting of findings should be made to management and to the affected employees.

<http://www.osha.gov/SLTC/indoorairquality/index.html>

<http://www.epa.gov/iaq/molds/>

<http://www.epa.gov/iaq/pubs/hpguide.html>

<http://www.cdc.gov/niosh/topics/noise/>

<http://www.cdc.gov/niosh/topics/heatstress/>

## **VIOLENCE PREVENTION**

Violence represents a common problem in health care – 12-14% of health care workers in the US experience at least one assault each year, and more assaults occur in health care than in any other industry in North America, though the rates of fatal assault are higher in some (cab drivers) and the incidence of deaths higher in others (construction). NIOSH has classified violence by perpetrator, as a more useful approach. Type 1 violence represents that by clients (students on teachers, patients on providers, prisoners on guards), type 2 criminal, type 3 family/spouse, and type 4 coworkers. More recently, organizations have begun classifying perpetrators by the type of violence, i.e., affective/reactive or predatory/instrumental, to reflect the level of sophistication and planning involved. Programs to prevent these different forms of violence require somewhat different approaches although response protocols often have substantial overlaps. Under-reporting of incidents is recognized as substantial with only 1 in 15 incidents leading to injuries reported to both security and workers' compensation systems.

The vast majority of events in health care represent patient assaults on providers. High-risk occupations include nursing (RN, LPN, and nurse's aide) and police and security staff. High risk locations include mental health, geriatrics, and emergency rooms. In general, the more intense the contact with patients, the higher the risk of assault. Intervention programs with documented effectiveness include education, flagging/warning of patients who have previously assaulted, and environmental intervention including wall colors, music, development of zero-tolerance policies, and plastic table ware.

Rates of co-worker assaults are lower than in general industry. Still, stressful working conditions and organization conflict are clearly associated with a wide range of violence, from passive aggressive behavior, including information withholding, to assault and battery with deadly weapons. Interventions include education, stress management, staffing improvement, supervisor training and support, and reporting.

OSHA has published and updated guidelines for the prevention of violence in health care. These guidelines address education and training, policy development, environmental management, and response procedures. In addition, OSHA has worked with CMS to develop an organization-specific strategy to develop and implement violence prevention programs. NIOSH similarly has guidance for violence prevention in the work place. A standard free training tool has evolved in the Veterans Health Administration from the original work on violence prevention in health care developed in the late 1970s. That program served as the core of many of the currently commercially available programs. No side-to-side comparisons of program effectiveness have been undertaken.

Effective programs require careful assessment of an organization's needs, location, staffing, and patients. Model policies should address the following major program elements:

- *Zero tolerance*  
Some policies explicitly state that no violence of any kind will be tolerated. Essential is the establishment of a clear definition of violent acts, clarity on consequences, and an institutional strategy for implementation. "Zero tolerance" approaches have been misused, in a number of settings, so that careful implementation is necessary including focusing on passive-aggressive behavior and provocation
- *Violence prevention through environmental design*  
The concept of defensible space, so effective elsewhere, is less useful in health care since contact between providers and patients is essential. Understanding the function of space, symbolically and practically, and how to use barriers, doorways, and privacy is essential.
- *Education and training*  
Initial awareness, acquisition of specific skills, and retraining at some defined frequency is important. Skills in de-escalating conflict, in personal safety (breaking holds), and reporting must be acquired.
- *Patient assessment and warning*  
A well-documented, very effective approach to reducing the frequency and severity of repeat assaults is to warn health care workers of prior assaults. This may occur through flags in an electronic medical record or some physical marker on paper charts. This approach requires the presence of a multidisciplinary committee, usually under senior clinical leadership, that reviews patient histories, evaluates the adequacy of medical care, and decides on the presence of a flag and its likely duration (time to re-review).

- *Threat assessment*  
Facilities must have resources to address the degree of real threat, both from patients and from staff and co-workers. Threat assessment training is available from several organizations.
- *Incident response*  
Alarms and warnings are essential to notification. These range from minor signage (raising a red folder in a public space) to use of emergency call buttons and cell phones with speed-dial systems. Facility wide announcements (“code orange”) are standard. Facilities tend to rely on therapeutic or police containment. The former requires a three-shift approach with at least three people per incident who use passive force and weight to bring a patient under control. Police force is self-explanatory. The former is far more respectful of patient care and ethics but requires a very high degree of training, scheduling coordination, and ongoing attention.
- *Post-incident management*  
Post-incident management approaches to the prevention of long-term consequences are available to patients/employees and bystanders. Victims may develop acute stress reactions, and warrant clinical treatment, or post-traumatic disorders. Critical incident stress debriefing has been shown, meanwhile, to perform at least no better than no treatment if not worse. A psycho-hygiene approach has been developed for bystanders.
- *Reporting and surveillance*  
Facilities should develop some approach to reporting, which may include electronic/remote call buttons, cell phone, and beepers. Reporting should lead to some structured response. Facilities should develop a system whereby they can collect information from both workers compensation and security/police reports to track incident frequency, locations, and perpetrators, in an attempt to evaluate program effectiveness.  
<http://www.cdc.gov/niosh/topics/violence/>  
<https://www.osha.gov/Publications/OSHA3828.pdf>  
<http://www.osha.gov/SLTC/workplaceviolence/index.html>  
[http://www.publichealth.va.gov/PUBLICHEALTH/employeehealth/threat\\_management/index.asp](http://www.publichealth.va.gov/PUBLICHEALTH/employeehealth/threat_management/index.asp)  
<https://www.osha.gov/Publications/osha3148.pdf>