Infection Control in Healthcare Personnel: Infrastructure and Routine Practices for Occupational Infection Prevention and Control Services

Centers for Disease Control and Prevention

National Center for Zoonotic and Emerging Infectious Diseases

Division of Healthcare Quality Promotion

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Table of Contents

List of Boxes, Tables, and Figures

Boxes:

Figures:

Tables:

1. Executive Summary

This document, *Infection Control in Healthcare Personnel: Infrastructure and Routine Practices for Occupational Infection Prevention and Control Services* (2017) is an update of two sections of the *Guideline for Infection Control in Healthcare Personnel, 1998*: *C. Infection Control Objectives for a Personnel Health Service* and *D. Elements of a Personnel Health Service for Infection Control.* Those sections described the infrastructure and routine practices of Occupational Health Services (OHS) for providing occupational infection prevention and control (IPC) services to healthcare personnel (HCP). The updated draft recommendations are aimed at the leaders and staff of OHS and the administrators and leaders of healthcare organizations, and intended to facilitate the provision of occupational IPC services to HCP.

The draft recommendations in this document address eight IPC elements of OHS:

1. Leadership and management
2. Communication and collaboration
3. Assessment and reduction of risks for infection among HCP populations
4. Medical evaluations
5. Occupational IPC education and training
6. Immunization programs
7. Management of potentially infectious exposures and illnesses
8. Management of HCP health records

In this document, "HCP" refers to all paid and unpaid persons serving in healthcare settings who have the potential for direct or indirect exposure to patients or infectious materials, including body substances, contaminated medical supplies and equipment, contaminated environmental surfaces, or contaminated air. For this document, HCP does not include dental healthcare personnel, autopsy personnel, and clinical laboratory personnel, as recommendations to address occupational infection control for these personnel are available elsewhere.

The term "healthcare settings" refers to places where healthcare is delivered and includes, but is not limited to, acute care facilities, long-term acute care facilities, inpatient rehabilitation facilities, nursing homes and assisted living facilities, home healthcare, vehicles where healthcare is delivered (e.g., mobile clinics), and outpatient facilities, such as dialysis centers, physician offices, and others.

The infrastructure and delivery of healthcare to patients, and hence the provision of occupational IPC services to HCP, has changed since the publication of the *Guideline for Infection Control in Healthcare Personnel, 1998*. The draft recommendations in this document update the *1998 Guideline* recommendations with:

- a broader range of elements necessary for providing occupational IPC services to HCP;
- applicability to the wider range of healthcare settings where patient care is now delivered, including hospital-based, long-term care, and outpatient settings such as ambulatory and home healthcare; and
- expanded guidance on policies and procedures for occupational IPC services and strategies for delivering occupational IPC services to HCP.

New topics include:

- administrative support and resource allocation for OHS by senior leaders and management,
- service oversight by OHS leadership, and

- use of performance measures to track occupational IPC services and guide quality improvement initiatives.

The draft recommendations are informed by a systematic literature review of recent articles consistent with current approaches in occupational IPC service delivery to HCP published in peer-reviewed journals or repositories of systematic reviews from January 2004-December 2015; and a review of occupational IPC guidelines, regulations, and standards. The draft recommendations are classified as good practice statements based upon the expert opinions of Workgroup members; and input from the Healthcare Infection Control Practices Advisory Committee (HICPAC).

2. Introduction

2.1 Scope and purpose of this update

The prevention of infectious disease acquisition and transmission among HCP and patients is a critical component of safe healthcare delivery in all healthcare settings. OHS provides occupational IPC expertise to a healthcare organization (HCO) and services to HCP, such as those aimed at reducing risks for acquiring infections on the job (e.g., immunizing HCP) and managing HCP infectious exposures and illnesses that prevent the transmission of infectious diseases from potentially infectious HCP to patients, HCP, and others.

In 1998, the Centers for Disease Control and Prevention (CDC) published *Guideline for infection control in healthcare personnel, 1998*,[1] which provided information and recommendations for OHS on the prevention of transmission of infectious diseases among HCP and patients. This update, *Infection Control in Healthcare Personnel: Infrastructure and Routine Practices for Occupational Infection Prevention Services* supersedes two sections of the *1998 Guideline*: *C. Infection Control Objectives for a Personnel Health Service* and *D. Elements of a Personnel Health Service for Infection Control*. The draft updated recommendations are intended to facilitate the provision of occupational IPC services to HCP and prevent transmission of infections between HCP and others.

2.1.1 Infection prevention and control objectives for an occupational health service

OHS objectives for IPC generally include:

- supporting a HCO safety culture;
- adhering to federal, state, and local requirements for occupational health and reporting;
- collaborating with others (e.g., facility IPC services) to monitor and investigate relevant infectious exposures, illnesses, and outbreaks involving HCP;
- identifying work-related infection risks and collaborating to institute appropriate risk reduction and preventive measures;
- providing HCP preventive measures (e.g. immunizations) and care for occupational exposures or illnesses;
- educating and training HCP about the principles of infection and injury prevention (e.g., sharps injuries)
- reducing absenteeism and disability among HCP; and
- ensuring confidentiality of HCP information consistent with federal, state, and local requirements.

2.1.2 Infection prevention and control elements of an occupational health service

The organizational structure of an OHS depends on the size of its parent HCO, the number of facilities served, the setting (e.g., inpatient- or outpatient-based), the numbers of HCP served, HCP job duties, and whether the services provided are on-site or off-site. Regardless of the structure of an OHS, program responsibilities include:

1. Leadership and management
2. Communication and collaboration
3. Assessment and reduction of risks for infection among populations of HCP
4. Medical evaluations
5. Occupational IPC education and training
6. Immunization programs
7. Management of potentially infectious exposures and illnesses
8. Management of HCP health records

This document does not address non-infectious elements of occupational health, such as slips, trips and falls, patient handling injuries, chemical exposures, HCP burnout, and workplace violence. It also does not provide immunization practice recommendations which are maintained by CDC and the Advisory Committee on Immunization Practices (ACIP).[2,3]

2.2 Rationale for this update

This updated document is intended to:

- address needs related to the growing diversity in models for providing occupational IPC services in healthcare settings (e.g., off-site service delivery);
- assist OHS to meet new regulatory requirements and standards from federal, state, and local jurisdictions, accreditation agencies, payers, and purchasers; and
- provide guidance on how to conduct performance measurement and quality improvement activities in the delivery of occupational IPC services.

2.3 Audience for the draft recommendations

These recommendations are aimed at two groups: the leaders and staff of OHS who provide occupational IPC services to HCP, and the administrators and leaders of HCO who provide resources for the delivery and management of occupational IPC services. Other groups, such as IPC staff, human resources departments, and regulatory compliance groups, also may find this document helpful.

2.4 Definition of healthcare personnel and healthcare settings

HCP refers to all paid and unpaid persons serving in healthcare settings who have the potential for direct or indirect exposure to patients or infectious materials, including body substances, contaminated medical supplies and equipment, contaminated environmental surfaces, or contaminated air. These HCP include, but are not limited to, emergency medical service personnel, nurses, nursing assistants, physicians, technicians, therapists, phlebotomists, pharmacists, students and trainees, contractual staff not employed by the healthcare facility, and persons not directly involved in patient care, but who could be exposed to infectious agents that can be transmitted in the healthcare setting (e.g., clerical, dietary, environmental services, laundry, security, engineering and facilities management, administrative, billing, and volunteer personnel). In this document, HCP does not

include dental healthcare personnel, autopsy personnel, and clinical laboratory personnel, as occupational IPC service recommendations for these groups are available elsewhere.[4-6] The term "healthcare settings" refers to places where healthcare is delivered and includes, but is not limited to, acute care facilities, long-term acute care facilities, inpatient rehabilitation facilities, nursing homes and assisted living facilities, home healthcare, vehicles where healthcare is delivered (e.g., mobile clinics), and outpatient facilities, such as dialysis centers, physician offices, and others.

2.5 Methods for developing the draft recommendations

The methods for the development of the draft recommendations in this document are described in *Appendix 3: Methods*.

2.6 References

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3. Leadership and Management

3.1 Background

Leader(s) of OHS oversee the delivery and monitor the quality of occupational IPC services. Planning and decision-making can be shared with other parts of the organization, including human resources, facility IPC services, facilities management, and environmental services. HCO leadership support for HIS leaders can facilitate intra-organizational collaboration and the effective provision of occupational IPC services.

OHS leaders can improve the delivery and quality of occupational IPC services by:

- developing both routine and emergency response policies and procedures for occupational IPC services,
- providing accountability for occupational IPC service delivery and quality,
- engaging in continuous quality improvement activities that improve OHS, and
- fostering collaboration with other departments or programs that address IPC.

Ensuring the provision of high-quality occupational IPC services can have many benefits, including:

- improvement of HCP health, job satisfaction, and morale,[1]
- support for a HCO safety culture,
- prevention of HCP infections and enhancing the health of patients and others (e.g., co-workers, family members) with whom HCP interact, and
- generation of economic savings for the OHS and HCO.

The leadership and management of OHS vary widely depending on HCO structure, the location of services with respect to HCP served, facility types and sizes, clinical activities, and HCP characteristics. These variations can affect how, and where, services are provided to HCP. Several organizations provide profession-specific certifications in occupational medicine that include occupational IPC services. For instance, the American Board of Preventive Medicine (ABPM) offers a Certification in Occupational Medicine, and the American Board for Occupational Health Nurses (ABOHN) offers credentialing as a Certified Occupational Health Nurse (COHN) and as a Certified Occupational Health Nurse-Specialist (COHN-S). Additional training for OHS leaders and staff focusing on occupational IPC can be developed by an individual HCO or OHS to address the specific needs of their work settings.

3.1.1 Compliance with requirements and standards

OHS leaders may be responsible for ensuring alignment with practice standards, such as clinical guidelines, as well as federal, state, and local requirements. Examples of federally mandated services include, but are not limited to, the Occupational Safety and Health Administration (OSHA) Bloodborne Pathogens Standard requirements for provision of exposure management services to employees[2] and the Personal Protective Equipment (PPE) Standard requirements for PPE training.[3]

In addition, OHS leaders can ensure alignment with HCO goals for accreditation and reimbursement. For example, The Joint Commission has requirements to establish annual influenza vaccination programs for HCP and to set goals for improving HCP influenza vaccination rates,[4] and Centers for Medicare & Medicaid Services (CMS) Conditions of Participation (CoP) include requirements that hospitals identify and track selected communicable diseases among HCP.[5]

3.1.1.1 Performance measurement and quality improvement

Performance measures are objective metrics of various aspects of a service's performance, such as service delivery or outcomes. They can be used to inform OHS and HCO leadership when occupational IPC services are not meeting goals; support the identification of areas for improvement; and quantify progress on quality improvement initiatives. Regulatory and accreditation groups, payers, and purchasers can require performance measurement or quality improvement activities for OHS, such as the CMS requirement to report HCP influenza immunization rates as a CoP.[5] Box 3.1 lists examples of performance measures for occupational IPC services; some can be used as measures for more than one service. Quality improvement (see Section **5. Assessment and Reduction of Risks for Infection among Healthcare Personnel Populations**) includes the identification and mitigation of barriers to success, such as access to care, quality of services, or other factors, such as staff awareness of when to seek OHS care.

3.1.2 Emergency planning and outbreak response

The transmission of emerging pathogens to HCP has been reported with increased frequency and highlights the importance of OHS participation in HCO planning for such events. Examples include HCP infections with pandemic influenza[6], Middle East Respiratory Syndrome Coronavirus,[7] and Ebola Virus.[8] Providing care for patients infected with emerging pathogens can necessitate non-routine occupational IPC services , such as training HCP in the use of unfamiliar PPE,[9] clinical and safety monitoring of HCP providing patient care,[10] and offering postexposure care. Similarly, outbreaks that involve HCP can require OHS assistance with contact tracing efforts, disease screening among HCP, and other activities (see section **9. Management of Potentially Infectious Exposures and Illnesses**).

3.2 Draft Recommendations

See section **4. Communication and Collaboration** for additional related draft recommendations.

3.2.1 For healthcare organization leaders and administrators

3.2.1a. Invest in an organizational culture that prioritizes safety and occupational infection prevention and control.

3.2.1b. Regularly review organizational information about occupational infectious risks, exposures, and illnesses with occupational health services.

3.2.1c. Dedicate one or more persons with appropriate authority and training to lead occupational infection prevention and control services.

3.2.1d. Provide sufficient resources (e.g., expertise, funding, staff, supplies, information technology) to implement elements of occupational infection prevention and control:

- Leadership and management,
- Communication and collaboration,
- Assessment and reduction of risks for infection among healthcare personnel populations,
- Medical evaluations,
- Occupational infection prevention and control education and training,
- Immunization programs,
- Management of potentially infectious exposures and illnesses, and
- Management of healthcare personnel health records.

3.2.1e. Oversee, and include occupational health services leaders in, performance measurement and continuous quality improvement activities for occupational infection prevention and control services.

3.2.2 For occupational health services leaders and staff

3.2.2a. Promote an organizational culture with a consistent focus on safety and occupational infection prevention and control.

3.2.2b. Develop occupational infection prevention and control services that are tailored to the needs of healthcare personnel.

3.2.2c. Develop, review, and update when necessary, written policies and procedures that adhere to federal, state, and local requirements for elements of occupational infection prevention and control services:

- Leadership and management,

- Communication and collaboration,
- Assessment and reduction of risks for infection among healthcare personnel populations,
- Medical evaluations,
- Occupational infection prevention and control education and training,
- Immunization programs,
- Management of potentially infectious exposures and illnesses, and
- Management of healthcare personnel health records.

3.2.2d. Inform all healthcare personnel and relevant healthcare organization departments about occupational infection prevention and control policies and procedures.

3.2.2e. Collaborate with appropriate healthcare organization departments and individuals to:

3.2.2.e1. achieve compliance with regulations related to occupational infection prevention and control;

3.2.2.e2. develop infectious disease emergency and outbreak management plans;

3.2.2.e3. develop and monitor performance measures for occupational infection prevention and control services that include the proportion of healthcare personnel with documented evidence of immunity and rates of healthcare personnel vaccination, as appropriate, for each vaccine-preventable disease recommended for healthcare personnel by CDC and the Advisory Committee on Immunization Practices (ACIP);

3.2.2.e4. set and meet quality improvement goals for occupational infection prevention and control services and report performance measures and areas for improvement to management;

3.2.2.e5. periodically assess the effectiveness of occupational infection prevention and control services.

3.3 References

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Box 3.1 Examples of Performance Measures that Might Be Used to Assess the Effectiveness of Occupational Infection Prevention and Control Services[a]

Occupational Infection Prevention and Control Services	Examples of Performance Measure(s)
Assessment and Reduction of Risks among Healthcare Personnel (HCP) Populations	• Number of HCP who sustain infectious exposure events • Number of HCP infectious exposure events through specific mechanisms (e.g., bloodborne pathogen exposures from sharps injury and mucosal exposure, or inappropriate use of personal protective equipment [PPE]) • Number of HCP who develop infections as a result of occupational exposures
Medical Evaluations	• Proportion of HCP who underwent preplacement evaluations • Proportion of HCP who completed serial screening for latent tuberculosis infection, when recommended by CDC • Proportion of HCP using N-95 respirators who received annual fit testing
Occupational Infection Prevention and Control (IPC) Education and Training Programs	• Proportion of HCP who completed initial and annual refresher occupational IPC education and training
Immunization Programs[b]	• Proportion of HCP with documented evidence of immunity for each vaccine-preventable diseases recommended for HCP by CDC/ACIP • Rates of completed HCP vaccination, when indicated, for each vaccine recommended for HCP by CDC and ACIP
Management of Potentially Infectious Exposures and Illnesses	• Proportion of HCP who sustained infectious exposures and were offered postexposure prophylaxis within recommended timeframes

[a]See section **3: Assessment and Reduction of Risks among Healthcare Personnel Populations** for further information on how to approach assessments and interventions to improve performance measures that do not meet goals.

[b]The National Healthcare Safety Network (NHSN) website (https://www.cdc.gov/nhsn/acute-care-hospital/hcp-vaccination/index.html) provides information on reporting HCP influenza immunization rates to NHSN.

4. Communication and Collaboration

4.1 Background

Effective internal communication and collaboration between OHS and other HCO departments and staff can benefit the safety of HCP and their patients.[1] OHS staff can maintain effective communication pathways with a variety of departments, including:

- IPC services
- Clinical services
- Engineering and facility management services
- Environmental services
- HCO leaders and managers
- HCP representatives
- Human resources
- Information technology services
- Laboratory services
- Legal departments (e.g., risk management)
- Pharmacies
- Procurement and central supply services
- Quality assurance and accreditation committees
- Safety committees
- Volunteer departments
- Worker's compensation

Explicit communication and collaboration between OHS and other HCO departments, particularly IPC services, can improve HCP safety and the delivery of occupational IPC services. Multidisciplinary committees can assemble diverse expertise to address cross-cutting issues such as assessing and selecting safety engineered needles[2]; developing tools to document HCP declination of immunization and to increase immunization rates[3]; and improving the capture and reporting of HCP immunization data (see section **8. Immunization Programs**).[4]

Communication and collaboration among OHS and supervisors, senior management, human resources, IPC services, and legal departments are necessary to decrease the likelihood of HCP reporting to work when ill and to encourage adherence to recommended work restrictions, when indicated.[1] Box 4.1 lists areas related to occupational IPC in which communication and collaboration can be important.

Barriers to effective communication and collaboration can include:

- dispersed staff and worksite locations (e.g., multi-hospital or healthcare setting network, contracted and off-site occupational health services); and
- different requirements for staff not directly employed by a facility, such as credentialed private practice physicians and contractors.

Additional areas for communication and collaboration are discussed in section **3, Leadership and Management**.

4.2 Draft Recommendations

See section **3. Leadership and Management** for additional related draft recommendations.

4.2.1 For healthcare organization leaders and administrators

4.2.1a. Establish organizational goals, policies and procedures, infrastructure, and interventions that foster communication and collaboration about occupational infection prevention and control.

4.2.2 For occupational health services leaders and staff

4.2.2a. Engage senior leaders, administrators, and leaders of other programs that share activities related to occupational infection prevention and control to foster collaborative decision-making.

4.2.2b. Participate in the development of policies, procedures, and interventions that affect occupational infection prevention and control.

4.3 References

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Box 4.1 Examples of Possible Areas of Collaboration for Occupational Infection Prevention and Control Services

Possible Areas of Collaboration and Roles for Occupational Health Services	Possible Internal Collaborators
Developing and disseminating policies and procedures about occupational infection prevention and control (IPC) related to: • Risk assessment and reduction (e.g., tracking of trends in sharps injuries, participating in prevention efforts, selecting and evaluating personal protective equipment (PPE)) • Respiratory protection programs • HCP immunization programs • Occupational infection prevention education and training • Medical evaluations • Infectious disease screening and surveillance (e.g., tuberculosis) • Management and reporting of exposures and illness among HCP • Work restrictions and clearance for returning to work • Sick leave • Infectious disease emergency planning/management (e.g., pandemic planning) • HCP records, information, and confidentiality	• Central supply/equipment purchasing services • Clinical services • Communications/marketing services • Environmental services • Engineering and facility management services • HCP representatives • Healthcare organization (HCO) leaders and managers • Human resources • IPC services • Laboratory services • Legal departments (e.g., risk management) • Pharmacy • Safety committee • Volunteer departments • Worker's compensation

Possible Areas of Collaboration and Roles for Occupational Health Services	Possible Internal Collaborators
Participating in risk assessment and reduction activities for occupational IPC: • Collect, report, and interpret data (e.g., HCP immunization rates, exposure event information/trends, illness rates, lost work days due to exposures or illness) • Improve immunization programs • Enhance exposure prevention efforts • Participate in inspections and evaluations of potential hazards to HCP • Participate in surveillance and epidemiologic investigations that involve HCP	• Clinical services • Construction services • Engineering and facility management services • Environmental services • Facilities management • HCP representatives • Human resources • Industrial hygiene • IPC services • Legal departments (e.g., risk management) • Procurement and central supply services • Safety committee • Volunteer departments
Assisting in accreditation and regulatory compliance activities pertaining to occupational IPC: • Track and ensure occupational IPC service compliance with regulations (e.g., federal, state and local), conditions of participation (e.g., Centers for Medicare & Medicaid Services (CMS)), and accreditation	• HCP representatives • Human resources • IPC services • Legal departments (e.g., risk management) • Quality improvement • Regulatory compliance unit • Safety Committee • Volunteer departments
Supporting HCP occupational IPC education and training: • Provide input on the curriculum, materials, and frequency of education and training for HCP • Participate in education and training	• Environmental services • HCP representatives • Human resources • IPC services • Procurement and central supply services • Safety committee • Volunteer departments
Contributing to HCP immunization programs: • Propose strategies to optimize immunization rates among HCP • Participate in collecting, interpreting, and reporting HCP immunization performance measures	• HCO leaders and managers • HCP representatives • IPC services • Legal departments (e.g., risk management) • Quality improvement • Regulatory compliance unit • Safety committee • Volunteer departments
Developing policies and procedures for HCP exposures and illness management: • Enable prompt access to OHS for exposures and illness management • Notify relevant departments and individuals about: o HCP exposures or illnesses, work restrictions, and clearance for return to work o Notification of contacts of infected or ill HCP o Results of exposure investigations (e.g., products or circumstances associated with exposures or illnesses)	• Clinical Services • HCP representatives • Human resources • IPC services • Laboratory services • Regulatory compliance (Occupational Safety and Health Administration (OSHA) standards) • Safety committee • Volunteer departments • Workers compensation

Possible Areas of Collaboration and Roles for Occupational Health Services	Possible Internal Collaborators
Contributing to product evaluation related to occupational IPC: • Provide input on PPE and patient care equipment (e.g., safety engineered sharps devices)	• Clinical services • Environmental services • Engineering and facility management services • HCP representatives • IPC services • Procurement and central supply services • Safety committee • Volunteer departments
Implementing methods for managing HCP health records: • Ensure confidentiality of medical information while maintaining ready access for urgent medical evaluations such as exposure or illness management • Utilize a confidential notification processes, such as for reporting HCP illnesses within the HCO or externally to public health departments	• HCP representatives • Human resources • Information technology services • Legal departments • Regulatory compliance unit (HIPAA) • Safety committee • Volunteer departments • Workers compensation
Collaborating in managing outbreaks involving HCP: • Report possible outbreaks detected among HCP to appropriate internal departments or individuals and external agencies (e.g., public health) • Assist with determining the nature of an HCP exposure and who else was potentially exposed • Monitor HCP for development of disease • Test HCP for infection • Evaluate, treat, and counsel exposed or ill HCP as appropriate	• Clinical services • HCP representatives • IPC services • Laboratory services • Legal departments • Safety committee • Communications/marketing services • Volunteer departments
Participating in planning for emergencies involving infectious diseases: • Evaluate event-specific policies, procedures, infrastructure, and interventions for occupational IPC services • Conduct site inspections and hazard evaluations • Develop event-specific occupational infection prevention and control education and training for HCP	• Clinical services • Communications/marketing services • Emergency response coordinator • Engineering and facility management services • Environmental services • HCO leaders and managers • HCP representatives • Human resources • IPC services • Laboratory services • Legal departments (e.g., risk management) • Procurement and central supply services • Safety committee • Volunteer departments

5. Assessment and Reduction of Risks for Infection among Healthcare Personnel Populations

5.1 Background

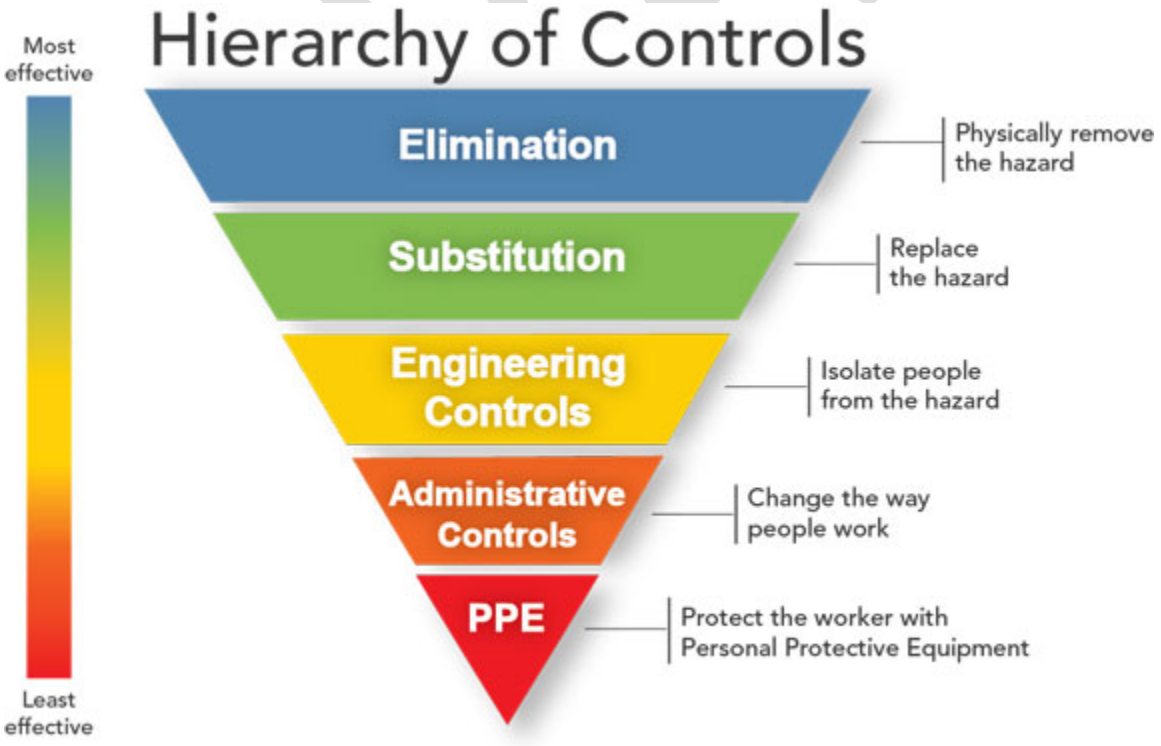
HCP are at risk of infectious exposures in the workplace that vary depending on their job duties.[1,2] Assessments can be conducted to identify actual or potential infection risks for populations of HCP and to inform measures that reduce those risks. Risk assessments can also yield data used for performance measurement, facility accreditation, service improvements, and other quality assurance activities (see section **3. Leadership and Management**). Risk assessments may be prompted by the desire to create a safer workplace, federal, state, or local requirements, and by incidents, such as reports of exposures or illnesses among HCP, infectious disease outbreaks, and device failures resulting in HCP exposures or injuries.

5.1.1 Approaches to risk assessment and reduction

Depending on HCO management structure and type of risk, OHS may lead some risk assessment and reduction activities or collaborate with other HCO departments, such as IPC services, that lead these efforts (see section **4. Communication and Collaboration**). Such activities could include improving access to services by providing resources at off-site job locations during work hours, or working with supply management counterparts to ensure HCP access to correct PPE. Box 5.1 lists examples of risk assessments and reduction strategies that might commonly involve OHS.

A model for risk assessment and reduction planning, the "Hierarchy of Controls" (Figure 1), is used to assess current or potential hazards in healthcare settings.[3] The hierarchy ranks controls according to their reliability and effectiveness, leading with "Elimination" of a potential hazard, whereby the risk is completely removed, and ending with "PPE" that relies on correct, consistent use.

Figure 5.1. Hierarchy of Controls



Source: Centers for Disease Control and Prevention (https://www.cdc.gov/niosh/topics/hierarchy/)

5.1.2 Selected requirements related to the assessment and reduction of occupational infection risks

Occupational IPC assessment activities are supported or required by federal, state, or local regulations, payers, and accreditation agencies. Requirements include, but are not limited to:

- OSHA requires HCO to maintain logs of work-related injuries and illnesses meeting certain criteria, including infectious diseases exposures.[4] Review of these logs can identify trends in occupational exposures or acquired infectious diseases among HCP that warrant mitigation.
- The OSHA Respiratory Protection Standard requires employers to conduct workplace evaluations to assess implementation of the respiratory protection program and correct any identified problems.[5]
- CMS requires that some HCOs report HCP influenza immunization rates to the National Healthcare Safety Network (NHSN) as CoP.[6]
- The Joint Commission standards require establishing an influenza vaccination program for staff, setting incremental vaccination goals to increase rates, and reporting HCP influenza immunization rates to key stakeholders.[7]

OSHA further supports risk assessment and reduction activities with online information and tools, including a job hazard analysis booklet and "eTools" about workplace health and safety topics.[8,9] OSHA also offers some employers free consultation on evaluating workplace hazards and control methods without risk of citations or fines.[10]

5.2 Draft Recommendations

See section **3. Leadership and Management** for additional related draft recommendations.

5.2.1 For healthcare organization leaders and administrators

5.2.1a. Regularly meet with occupational health services leaders to review results of risk assessments related to occupational infection prevention and control, set performance goals, and charge relevant healthcare organization departments and individuals to reduce risks.

5.2.2 For occupational health services leaders and staff

5.2.2a. Conduct, or collaborate with other healthcare organization departments or individuals in, regular risk assessments and risk reduction activities related to occupational infection prevention and control.

5.2.2b. Notify healthcare organization leaders and departments about hazards identified and risk reduction plans, progress, and priorities for healthcare personnel.

5.3 References

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Box 5.1 Examples of Hazard Identification, Risk Assessment, and Risk Reduction Activities in which Occupational Health Services Might Participate

Possible Hazard(s) Identified	Example Assessment Method	Risk Reduction Plan Example (Control Addressed)[a]
Sharps injuries among surgeons when suturing fascia with sharp suture needles	Review of logs of sharps injuries (e.g., OSHA 300 forms) to understand trends	Revise HCO policies (e.g., HCO equipment purchasing, operating room procedures) to using only blunt-tipped suture needles for suturing fascia (elimination/substitution)
Sharps injuries on a single unit/floor linked to inconvenient sharps container placement	Review of logs of sharps injuries (e.g., OSHA 300 forms) to understand trends	Move sharps containers to accessible locations (engineering control)
Sharps injuries among HCP using a newly introduced syringe with a sharps safety feature; HCP reported no training on using the new device	Review of logs of sharps injuries (e.g., OSHA 300 forms) to understand trends	Develop procedures for HCP training on new products prior to use (administrative control)
Lowest influenza immunization rates among HCP in an outpatient, free-standing facility; immunizations were not offered on-site	Review of HCP immunization records and interviews with HCP	Offer on-site immunization of HCP at outpatient sites during work hours (administrative control)
HCP tuberculosis infections over the past 6 months on one hospital unit	Review of HCP health records and interviews with HCP	Repair of malfunctioning negative pressure in an airborne infection isolation room (engineering control)

Possible Hazard(s) Identified	Example Assessment Method	Risk Reduction Plan Example (Control Addressed)[a]
HCP who presented to OHS over the past 6 months had come to work when already ill; reasons included fear of consequences for missing work and lack of paid sick leave	Review of HCP health records and interviews with HCP	Revise sick leave policies to ensure they are non-punitive and inform HCP of the changes (administrative control)

[a]See Figure 1. Hierarchy of Controls

6. Medical Evaluations

6.1 Background

OHS provide or refer HCP for pre-placement medical evaluations (PPME) before starting job duties and for periodic and episodic medical evaluations during the course of employment in order to:

- ensure HCP have recommended evidence of immunity to vaccine preventable diseases[1,2];
- assess and manage occupationally- and non-occupationally-acquired conditions and illnesses that affect HCP safety in the workplace;
- prevent, evaluate, and manage infectious exposures or illnesses acquired or transmitted by HCP in healthcare settings; and
- provide individualized health counseling.

Health counseling for HCP can include topics such as:

- the risk for and prevention of occupationally-acquired infections;
- risk for, and prevention of, transmission of infections to others (e.g., HCP, patients, HCP family members);
- strategies for the prevention and management of exposures and illnesses, such as the risks and benefits of postexposure prophylaxis and the importance of staying home when ill or potentially contagious to others; and
- other HCP health concerns that may affect the risk of acquiring or transmission infections, such as pregnancy, HIV infection, or other immunocompromising conditions.

6.1.1 Pre-placement medical evaluations

The objectives of PPME can include:

- Documenting the baseline health status of HCP;
- Implementing measures to reduce HCP risk of acquiring or transmitting infections in healthcare settings, such as
    - ensuring HCP have recommended evidence of immunity to vaccine preventable diseases[1,2];
    - providing or referring for preplacement testing (e.g., tuberculosis [TB] screening), if indicated[3,4];
    - providing or referring for medical clearance and respirator fit-testing;
- Assessing job placement and providing “clearance for duty;” and
- Informing HCP about OHS expectations, services provided, and confidentiality of health information.[5]

6.1.2 Periodic medical evaluations

These evaluations occur after job placement and address routine issues, such as follow-up on issues identified during the PPME, routine screening and testing,[1-3] immunization, and other recurrent services.

6.1.3 Episodic medical evaluations

These evaluations are precipitated by, and limited to, an event that warrants evaluation, such as an infectious exposure. They enable OHS to manage HCP exposures or illnesses, including delivery of postexposure care and monitoring.

6.1.4 Delivery and access to medical evaluations

Ideally, OHS offers on-site clinical services, such as point-of-care testing (e.g., HIV testing), first aid and wound management after sharps injuries, and illness evaluations. On-site access to such services can hasten identification and management of potentially contagious illnesses, build HCP trust in OHS staff, and maintain the stability of the HCP workforce.[5] When OHS services are provided off-site, location and hours of availability of care can create challenges in providing timely service access to address urgent issues, such as reporting bloodborne pathogen exposures and determining the need for postexposure prophylaxis.[6]

6.1.5 Communication and confidentiality of information obtained in medical evaluations

OHS staff routinely need to communicate with other parts of the healthcare facility or system (see section **4. Communication and Collaboration**). Electronic HCP records and databases can speed access to information and databases can facilitate functions such as risk assessments and performance measurements; however, appropriate confidentiality safeguards including strict control of access to information are important to ensure HCP data safety. Communication regarding the exchange of identifiable health information may be subject to authorizations (e.g., the Health Insurance Portability and Accountability Act (HIPAA))[8] or government regulations (e.g., OSHA) (see section **10. Management of HCP Health Records)**.

6.1.6 Selected requirements that affect the provision of medical evaluations

The Americans with Disabilities Act (ADA) prohibits employers from asking job applicants to undergo medical evaluations before making job offers, or from making pre-employment inquiries about disabilities. It also limits if and how employers may ask employees about medical illnesses and potential disabilities, and requires employers to provide "reasonable accommodation" to enable HCP to perform the essential functions of their jobs.[9] Some state and local governments have additional laws and regulations that specify medical or functional requirements for workers in healthcare settings.

The OSHA Bloodborne Pathogens Standard requires that employees are offered Hepatitis B immunization before starting work, job-related post-exposure management services, and medical services.[10] The OSHA Respiratory Protection Standard requires initial medical evaluations as part of a respiratory protection program, as well as fit testing, training, and medical re-evaluations, when indicated, as described in the Standard.[11]

6.2 Draft Recommendations

6.2.1 For healthcare organization leaders and administrators

6.2.1a. Provide job descriptions with sufficient detail to assess job-related infection risks to occupational health services staff before the pre-placement medical evaluation.

6.2.2 For occupational health services leaders and staff

6.2.2a. Develop, review, and update when necessary, policies and procedures for providing preplacement, periodic, and episodic medical evaluations that include health assessments, screening and diagnostic testing, immunization services, exposure and illness management, counseling, and reporting of findings of medical evaluations

6.2.2b. For **preplacement medical evaluations**

6.2.2.b1. Review each employee's job description for duties that may affect risk of acquiring or transmitting infections in healthcare settings.

6.2.2.b2. Collect a directed health inventory to assess:

- history of medical conditions, and other factors that may affect the risk of acquiring or transmitting infections in healthcare settings, and
- evidence of immunity to vaccine-preventable diseases recommended for healthcare personnel by CDC and the Advisory Committee on Immunization Practices (ACIP).

6.2.2.b3. Conduct or refer healthcare personnel for physical examination, as indicated, to assess medical conditions that might affect risk of acquiring or transmitting infections in healthcare settings.

6.2.2.b4. Conduct or refer healthcare personnel for infectious diseases screening as recommended by CDC.

6.2.2.b5. Test for evidence of immunity to vaccine-preventable infections as recommended by CDC and ACIP.

6.2.2.b6. Provide or refer healthcare personnel for services that reduce risks of infectious disease transmission (e.g., immunizations, medical clearance for respirator fit testing).

6.2.2.b7. Provide or refer healthcare personnel for information regarding:

- health conditions that may increase their risk of acquiring or transmitting infections in healthcare settings, and recommended actions to reduce those risks;
- procedures for preventing and managing workplace exposures and illnesses;
- work restrictions and sick leave policies; and
- confidentiality of their health information.

6.2.2c. For **periodic medical evaluations**

6.2.2.c1. Provide additional doses of vaccines recommended for healthcare personnel by CDC and ACIP.

6.2.2.c2. Perform or refer healthcare personnel for indicated follow-up testing.

6.2.2.c3. Conduct periodic screening for tuberculosis, if indicated, as recommended by CDC.

6.2.2.c4. Provide or refer healthcare personnel for periodic respirator fit testing, if indicated.

6.2.2d. For **episodic medical evaluations**, conduct or refer healthcare personnel for medical evaluations on an as-needed basis to:

6.2.2.d1. evaluate and manage potentially infectious exposures and illnesses;

6.2.2.d2. evaluate and manage new health conditions (e.g., pregnancy, rashes) that may affect risk of acquiring or transmitting infections or ability to perform job functions;

6.2.2.d3. provide pre-placement medical evaluations for healthcare personnel who are changing job duties;

6.2.2.d4. survey healthcare personnel for exposures and/or illness during outbreaks of infectious diseases in healthcare settings, if indicated.

(see section **9. Management of Potentially Infectious Exposures and Illnesses** for additional related recommendations)

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7. Occupational Infection Prevention and Control: Education and Training

7.1 Background

Occupational IPC education and training programs are intended to increase HCP knowledge, competency, and practical skills about infectious diseases and their prevention. These programs are generally managed by the IPC program of a facility or HCO.

Understanding the rationale for IPC practices can increase HCP adherence to, and acceptance of, those practices.[1,2] In addition, education and training can:

- ensure HCP are provided with and become familiar with organizational OHS and IPC policies and procedures;
- increase HCP acceptance of immunizations;
- encourage prompt recognition, reporting, evaluation, and management of HCP exposures and illnesses;
- decrease infections among HCP;[3]
- facilitate control of infectious disease outbreaks;[4] and
- ensure adherence to federal, state, and local education and training requirements.

Education and training are typically provided to HCP initially upon hire; periodically during employment, such as via annual refresher training; and as needed to address a specific need, such as new job duties, new medical equipment, or outbreak control.

7.1.1 Education and training requirements

In addition to standard education and training that is expected for HCP to safely perform their work, federal (see Box 7.1), state, and local authorities maintain mandated requirements for the education and training of employees.[-5-7]

7.2 Draft Recommendations

7.2.1 For healthcare organization leaders and administrators

7.2.1a. Provide healthcare personnel dedicated time during work hours to complete occupational infection prevention and control education and training.

7.2.2 For occupational health services leaders and staff

7.2.2a. Collaborate with appropriate healthcare organization departments or individuals to:

7.2.2.a1. define the goals and scope of education and training for healthcare personnel about occupational infection prevention and control;

7.2.2.a2. support initial, periodic, and as-needed education and training that is appropriate in content to the educational level, literacy, and language of healthcare personnel;

7.2.2.a3. periodically review healthcare personnel exposure data to identify high risk sub-populations for refresher infection prevention and control education and training.

7.2.2b. Determine periodic “refresher” education topics based upon analyses of healthcare personnel exposure incident reports, risk assessments, and other methods that identify infectious hazard vulnerabilities for healthcare personnel.

7.2.2c. Topics for initial, periodic, and as needed education and training should include:

- Federal, state, and local education and training requirements

- Modes of infectious disease transmission and implementation of standard and transmission-based precautions
- Hand hygiene
- Sharps injury prevention
- Immunizations recommended by CDC and the Advisory Committee on Immunization Practices (ACIP) for healthcare personnel
- Healthcare personnel screening for selected infectious diseases before job placement and periodically thereafter
- How to access occupational health services, when needed, and the need to report exposures
- Expectations for reporting illnesses or conditions (work-related or acquired outside of work), such as rashes or skin conditions (e.g., non-intact skin on hands); febrile, respiratory, and gastrointestinal illnesses, and hospitalizations resulting from infectious diseases
- Sick leave and other policies and procedures related to infectious healthcare personnel, including the risks of presenteeism to other healthcare personnel and patients

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Box 7.1 Examples of Federal Regulations Requiring Education and Training for Employees

Selected Federal Regulations	Selected Education and Training Elements
Bloodborne Pathogens Standard (https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=10051)	• Bloodborne pathogens epidemiology, modes of transmission • Hepatitis B immunization • Postexposure management • Sharps device safety

Selected Federal Regulations	Selected Education and Training Elements
Respiratory Protection Standard (https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=12716)	• Respiratory hazards to which HCP might be exposed • Use of respirators
Personal Protective Equipment (PPE) Standard (https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9777&p_text_version=FALSE)	• When PPE is necessary • What PPE is necessary • How to properly don, doff, adjust, and wear PPE • Limitations of PPE • Proper care, maintenance, useful life, and disposal of PPE

8. Immunization Programs

8.1 Background

Immunization programs provide a set of services that ensure immunity to vaccine preventable diseases, including documenting evidence of immunity,[1] administering immunizations and re-immunizations, and record-keeping and reporting to state or local immunization information systems (IIS), also known as vaccine registries. A program might support additional immunization services, such as pre-travel vaccines for HCP working abroad, or might arrange for such services with an external provider. Effective programs can:

- prevent vaccine preventable diseases among HCP[1,2];
- prevent illness among patients[1] and others, such as HCP family and household members, by reducing their risk of encountering infectious HCP;
- adhere to CDC and ACIP immunization recommendations for HCP[1,2] and federal, state, and local requirements[3];
- reduce the need for, and costs related to, reactive measures, including postexposure prophylaxis, use of sick leave, and work restrictions; and
- increase the efficiency of reporting HCP immunization information internally, as for performance measurement and quality improvement initiatives, and to external groups, such as payors and public health agencies.[4]

The ACIP website (https://www.cdc.gov/vaccines/hcp/acip-recs/index.html) provides criteria for evidence of immunity to vaccine preventable diseases, immunization recommendations for HCP, and information on immunization program administration, such as instructions for storage and handling of immunobiologics, vaccine administration, documentation, and reporting of adverse events. Additional information on IIS, including contact information for state or local immunization programs through which links to IIS can be established, is available on the CDC IIS website (https://www.cdc.gov/vaccines/programs/iis/index.html).

8.1.1 Selected federal requirements and accreditation standards

The OSHA Bloodborne Pathogens Standard requires that the Hepatitis B vaccine be offered to all employees at the employer's expense, and that the vaccine be available for postexposure management.[3] Employees may refuse immunization but must sign a declination form that uses OSHA-prescribed language. Refer to the OSHA website (https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10051) for details. State and local requirements related to HCP immunizations and immunization programs vary by jurisdiction. In

addition, payers - including CMS - and accreditation agencies may have requirements related to HCP immunization, such as reporting immunization rates to the National Healthcare Safety Network (NHSN) and setting goals to improve immunization rates.[5,6]

8.1.2 Barriers to immunization

Despite existing recommendations and requirements for immunization of HCP, HCP immunization rates are suboptimal.[7,8] Barriers to vaccination vary depending on HCP subgroup and work setting. Barriers can include fear of adverse events from vaccination, including injection aversions; inconvenient access to vaccination (e.g., location, hours of service); lack of perceived need for vaccination (e.g., perception of low risk of acquiring a disease or low vaccine efficacy); and lack of leadership support for vaccination.[8-11]

8.1.3 Strategies for improving HCP immunization rates

CDC and ACIP provide information on strategies to increase immunization rates (https://www.cdc.gov/vaccines/hcp/acip-recs/general-recs/programs.html#t-01). It has been shown that comprehensive immunization programs that include mandatory immunization policies reliably and substantially increase receipt of preplacement and annual vaccines.[12-13] Strategies other than mandatory policies that have been used in healthcare facilities to increase immunization rates include[8-10,12-18]:

- Using organizational leaders as role models (e.g., visibly vaccinating institutional leaders to improve rates among HCP under their leadership);
- Conducting education or organizational campaigns to promote awareness and knowledge about vaccines;
- Providing free access (no out-of-pocket expense to HCP) to vaccine;
- Providing incentives to encourage immunization, such as coupons for the hospital cafeteria, gift certificates, etc.;
- Offering flexible worksite vaccine delivery (e.g., at multiple locations and times, via mobile carts);
- Obtaining signed declinations for vaccine from HCP with non-medical reasons to decline vaccination; and
- Monitoring and reporting vaccination rates (e.g., monitoring vaccine coverage by facility ward to identify areas with low coverage for targeted interventions to increase vaccination rates).

8.2 Draft Recommendations

8.2.1 For healthcare organization leaders and administrators

8.2.1a. Set goals to achieve high rates of evidence of immunity to vaccine-preventable diseases recommended for healthcare personnel by CDC and the Advisory Committee on Immunization Practices (ACIP).

8.2.2 For occupational health services leaders and staff

8.2.2a. Develop, review, and update when necessary immunization program policies and procedures that:

8.2.2.a1. adhere to the CDC and ACIP recommendations for immunizing healthcare personnel;

8.2.2.a2. indicate all preplacement, annual, and other job-related immunizations that healthcare personnel should receive;

8.2.2.a3. specify strategies to offer vaccines to healthcare personnel and to achieve high immunization rates;

8.2.2.a4. specify strategies for gathering and reviewing information on why recommended immunizations are not administered to inform program quality improvement.

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9. Management of Potentially Infectious Exposures and Illnesses

9.1 Background

HCP can be exposed to potentially infectious blood, tissues, secretions, other body fluids, contaminated medical supplies and equipment, environmental surfaces, water sources, or air in healthcare settings. Mechanisms of occupational exposures include percutaneous injuries such as needlesticks, mucous membrane or non-intact skin contact via splashes or sprays, and inhalation of aerosols. HCP can also be exposed to infectious diseases in the community and risk transmitting them to others at work.

Appropriate management of potentially infectious exposures and illnesses among HCP can prevent the development and transmission of infections. Effective management of exposures and illnesses includes promptly assessing exposures and diagnosing illness, monitoring for the development of signs and symptoms of disease, and providing appropriate postexposure or illness management. Providing exposure and illness management services also affords the opportunity for counseling to address HCP concerns about issues such as potential infection, adverse effects of postexposure prophylaxis, and work restrictions.

9.1.1 Exposure management

A substantial number of infectious exposures occur in the workplace, despite longstanding regulations and guidelines in place for their prevention,[1-4] and providing timely and effective exposure management services can be challenging. Bloodborne pathogen exposures among HCP subpopulations, including trainees, technicians, surgeons, medical staff, and nurses, are significantly underreported.[5-7] Time constraints, fear of reprimand, lack of information on how to report exposures, and cost coverage of exposure management have been identified as factors in not reporting exposures.[6] While many HCP may be guaranteed cost coverage for job-related exposure and illness by Workers Compensation Laws, not all HCP, such as volunteers and trainees, may have this benefit.

Off-site services can be a barrier to accessing care if they are inconveniently located. When timeliness is critical for provision of prophylaxis or expert consultation and management (see section **9.2.4 Expert consultation and management services)**, such as after a needlestick injury from an HIV-infected source, off-site services may not be sufficient.

Identifying whether an exposure to an infectious disease has occurred can be challenging and depend upon eliciting the circumstances of the (sometimes remote) exposure incident, including where, when, and how the exposure occurred, the duration and extent of the exposure, and whether appropriate PPE was used. Some guidelines provide disease-specific guidance on how to determine if an occupational exposure has occurred.[8,9]

Efficient management of HCP exposures can benefit from procedures that streamline and enable HCP exposure reporting and service access. Patient care processes are an important aspect of HCP exposure management. For example, some HCO request patients to sign an advance release that allows for bloodborne pathogen testing should an HCP exposure occur during the course of their care.

9.1.2 Illness management

Treatment and containment of infectious illnesses among HCP can protect patients and coworkers from infection. Occupationally- and community-acquired infections can both be of concern. A prominent issue is "presenteeism;" that is, HCP reporting to work when sick.[11] Whether because of individual work ethic, local culture (e.g., unwillingness to disappoint colleagues), or financial pressures such as a lack of paid sick leave, presenteeism puts others at risk. Eliciting reasons for HCP presenteeism may inform methods to reduce the problem. Developing policies that discourage presenteeism can be challenging, as contractual staff employers and self-employed HCP may have different rules about missing work.

9.1.3 Selected federal requirements for exposure and illness management

Federal requirements affect the delivery of exposure or illness management services. Affected services include:

Employer inquiry about infectious illnesses among HCP:

- The Americans with Disabilities Act limits if and how employers may ask employees about medical problems, illnesses, and potential disabilities.[10]

Provision of exposure or illness management services:

- The OSHA Bloodborne Pathogens Standard contains requirements for the provision of job-related exposure and illness management services related to bloodborne pathogens.[3]

Notification of HCP potentially exposed to infectious pathogens:

- The Ryan White Act mandates notification of emergency response personnel possibly exposed to selected infectious diseases. In accordance with the Ryan White Act, CDC maintains a list of infectious disease exposures that must be reported to emergency response personnel, as well as reporting requirements.[13]

Work Restrictions:

- The ADA contains provisions that affect how work restrictions are applied. Employers are required to provide reasonable accommodation so that HCP can perform the essential functions of their job.[10]
- Work restrictions are typically communicated to appropriate individuals and HCO authorities, such as supervisors and human resources departments, while maintaining the HCP right to privacy. The HIPAA Privacy Rule provides federal protections for individually identifiable health information held by covered entities and their business associates and gives individuals an array of rights with respect to that information. At the same time, the Privacy Rule is balanced so that it permits the disclosure of health information needed for patient care and other purposes. Detailed information on the HIPAA Privacy Rule can be found at the US Department of Health & Human Services website (http://www.hhs.gov/ocr/privacy/hipaa/understanding/index.html).

Sick Leave:

- The Family Medical Leave Act (FMLA) entitles eligible employees of covered employers to take unpaid, job-protected leave for specified family and medical reasons with continuation of group health insurance coverage under the same terms and conditions as if the employee had not taken leave. The FMLA provides specific leave time allowances, as long as they meet specific criteria.[14] Details regarding employee eligibility and covered employers are available at the US Department of Labor website (https://www.dol.gov/whd/regs/compliance/whdfs28.pdf).

Additional state and local requirements may also apply to exposure and illness management services.

9.1.4 Expert consultation and management services

The capacity for providing exposure and illness management services varies by OHS. Depending upon clinical circumstances, expert consultation may be appropriate for managing exposures to infections or illnesses such as HIV[8] and hepatitis C.[15,16] OHS locations and healthcare settings may not have such experts available on site, and arranging for consultation can require advanced planning. Methods to facilitate expert consultation include standing agreements with on-site or contracted experts[17,18] and the use of decision support resources, such as telemedicine services and accessing exposure and illness management guidelines or protocols electronically.[17,18]

9.1.5 Work restrictions

Work restrictions exclude potentially infectious HCP from the workplace or specifically from patient contact to prevent transmission of infectious diseases. Work restrictions may also be implemented when HCP are at increased risk for infection, such as restricting susceptible HCP contact with patients with varicella zoster when immune HCP are available.[19] Exclusion can be based on time, or evaluation for clearance to return to work, depending on the infection. Reluctance to report exposures and illnesses and concerns regarding missed work can make work restrictions difficult to implement. Staffing limitations can also affect implementation of work restrictions. Alternative work options that minimize risk to others (e.g., telework for infectious workers), and utilizing paid sick leave days or job-protected leave (e.g., provided by the FMLA[14]) may reduce the negative impacts of work restrictions.

9.1.6 Outbreak detection and management

When OHS detects an outbreak among HCP, internal coordination with other HCO departments, such as IPC services, is essential, as is notification of the appropriate public health authorities. When HCP testing is required, clinical laboratory counterparts are part of the response planning process.[11,21] OHS can also inform post-outbreak assessments to identify options for preventing future outbreaks.[22]

9.1.7 Reporting HCP exposures and illnesses

All states and territories have requirements for reporting selected infections or infectious conditions in persons to health departments.[23,24] Reporting of notifiable infections can hasten identification of chains of transmission and outbreaks and facilitate health department assistance with notifying contacts.

Adverse events due to medical equipment and devices can result in HCP exposure to infectious diseases (e.g., sharps injuries), and devices involved in such exposures due to a quality problem or other issues can be reported to the US Food and Drug Administration (FDA) MedWatch database (https://www.fda.gov/Safety/MedWatch/default.htm).[25] Reporting to the FDA MedWatch Database is voluntary, but serves to identify device-related hazards that might warrant review.

9.2 Draft Recommendations

9.2.1 For healthcare organization leaders and administrators

9.2.1a. Implement sick leave options for healthcare personnel, and whenever possible, contract staff, that encourage healthcare personnel reporting of exposures or illnesses, appropriate use of sick leave, and adherence to work restrictions.

9.2.2 For leaders and staff of occupational health services

9.2.2a. Develop, review, and update when necessary policies and procedures about healthcare personnel exposure and illness management services that:

9.2.2.a1. Include methods to provide job-related exposure and illness management services;

9.2.2.a2. Establish a timely, confidential, and non-punitive mechanism for healthcare personnel to report exposures and access exposure and illnesses management services 24 hours a day and 7 days per week;

9.2.2.a3. Include sick leave options that encourage healthcare personnel reporting of exposures and illness and discourage presenteeism;

9.2.2.a4. Facilitate access to clinical providers with expertise in exposure and illness management who are available 24 hours a day and 7 days per week;

9.2.2.a5. Facilitate prompt access to laboratory testing and treatment for managing exposures and illnesses;

9.2.2.a6. Describe work restrictions for exposed or ill healthcare personnel that:

9.2.2.a6a. Specify criteria for work restrictions,

9.2.2.a6b. Specify methods of communication between occupational health services, healthcare personnel, and others (e.g., human resources, managers) about work restrictions; and

9.2.2.a6c. Identify how work restrictions are imposed and healthcare personnel are cleared for return to work.

9.2.2b. Define criteria, methods, and individuals responsible for reporting healthcare personnel exposures and illnesses or suspected infectious outbreaks to internal departments and external authorities.

9.2.2c. Provide or refer healthcare personnel who have sustained job-related potentially infectious exposures or illnesses for prompt management that includes:

9.2.2.c1. Evaluating the exposed or ill healthcare personnel;

9.2.2.c2. Evaluating the exposure incident and source, including whether the source was potentially infectious and whether others remain at risk;

9.2.2.c3. Arranging for any needed testing;

9.2.2.c4. Counseling about:

- risk of exposure or illness,
- testing,
- options for and risks and benefits of postexposure prophylaxis or treatment,
- need for specialty care,
- follow-up testing and treatment,
- work restrictions, if indicated,
- risk of transmitting infections to others and methods to prevent transmission, and
- signs and symptoms of illness to report after an exposure including potential side effects of prophylaxis.

9.2.2.c5. Offering prophylaxis or treatment, if indicated; and
9.2.2.c6. Offering follow-up care.

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10. Management of Healthcare Personnel Health Records

10.1 Background

OHS collects, maintains, reports, and ensures confidentiality of HCP health information in order to provide efficient occupational IPC services. OHS maintains HCP information related to preplacement, periodic, and episodic medical evaluations as provided by OHS or other consulted external medical providers, such as:

- job-related, infectious diseases screening;
- evidence of immunity to vaccine-preventable diseases;
- offered and administered immunizations[1];
- exposure and illness management services; and
- counseling services.

Information systems designed to record and rapidly retrieve confidential HCP data can enable efficient responses to infectious exposures and outbreaks. The systems can also highlight trends in infectious disease risk, exposures, and illnesses among HCP.

10.1.1 Electronic health records and electronic information systems

Electronic health record (EHR) and other electronic health information systems can provide options that might enhance HCP records management. EHR can automatically generate alerts, such as those about the need for

postexposure follow-up, immunizations, or other services. They can also facilitate access to HCP-related information entered by other departments, such as information on work restrictions entered by the human resources department, to allow communication and shared decision-making about HCP.

The use of EHR can expedite mandated reporting of immunization data and trend analyses of vaccination rates,[2] as well as facilitate other risk assessment and reduction activities and quality improvement efforts. EHR use can improve documentation of vaccine contraindications and reduce medical discrepancies (e.g., HCP receiving an immunization despite reporting an immunization contraindication) to ensure HCP safety.

10.1.2 Selected HCP record documentation and retention requirements

OSHA requirements related to occupational exposures and acquired infections include establishing and retaining employee medical records, maintaining confidentiality, and providing records to employees when requested.[3-6] OSHA requires employers to record certain work-related injuries and illnesses on the OSHA 301 "Injury and Illness Report" form, maintain the OSHA 300 "Log of Work-Related Injury and Illnesses," and annually complete the OSHA 300A "Summary of Work-Related Injury and Illnesses."[7] In addition, the OSHA Respiratory Protection Standard requires documentation of medical clearance and other services related to respirator use. Other federal, state, and local documentation requirements for occupational IPC services may exist.

10.1.3 Reporting HCP information

OHS may need to report aggregated (and de-identified) health information to various sources, and to do so electronically. Sources might include internal departments or individuals, such as IPC services and senior management, or external sources, such as NHSN.[8]

10.1.4 Confidentiality and security of HCP health information

Safeguarding the confidentiality of HCP health information ensures compliance with requirements[9] and can build HCP confidence in OHS. Defining who may access confidential HCP health records can facilitate protection of HCP information and enforcement of record access restrictions. Keeping HCP records and information in the same system as patient care information can risk unauthorized staff access to private information. Some HCO separate patient and HCP records by using separate paper files or electronic systems. State and local requirements for the separation of patient and HCP records may exist.

The 1996 HIPAA Privacy Rule[10] provides federal protections for individually identifiable health information held by covered entities and their business associates, and grants patients several rights with respect to that information. Requesting or providing HCP medical information or records may require HIPAA-compliant consent, depending on the purpose and recipient of the information.

10.2 Draft Recommendations

10.2.1 For healthcare organization leaders and administrators

10.2.1a. Establish systems to maintain confidential work-related healthcare personnel health records, preferably in electronic systems, that:

- 10.2.1.a1. limit access only to authorized personnel,
- 10.2.1.a2. enable rapid access by authorized clinical providers,
- 10.2.1.a3. facilitate aggregation and de-identification of information,

10.2.1.a4. allow tracking and assessments of trends in infectious risks, screening tests, exposures, and infections, and

10.2.1.a5. enable confidential reporting to internal departments and individuals or external groups.

10.2.1b. Consider enabling electronic system features that:

10.2.1.b1. Notify occupational health services when occupational infection prevention and control services are due, and

10.2.1.b2. communicate work restrictions with other healthcare organization data systems (e.g., human resources information systems).

10.2.2 For leaders and staff of occupational health services

10.2.2a. Participate in the development of policies and plans that facilitate confidential, efficient exchange of healthcare personnel health information.

10.2.2b. Maintain healthcare personnel records and databases that include medical evaluations, infectious disease screening, evidence of immunity and immunizations, exposure and illness management, and work restrictions.

10.2.2c. Maintain confidentiality, use appropriate authorizations, and provide only necessary information when sharing healthcare personnel records.

10.2.2d. Facilitate healthcare personnel data aggregation for reporting performance measures and supporting occupational health services quality improvement activities.

10.2.2e. Make copies of individual records promptly available to healthcare personnel upon their request, preferably within 15 days.

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Workgroup Declarations of Interest

None of the Workgroup members reported financial or intellectual interests related to the topics in this guideline except for the following:

- Ruth Carrico: Speaker and consultant for Pfizer; speaker for Sanofi Pasteur; consultant for Medscape; speaker and workgroup member of the Gerontological Society iCAMP workshop committee; recipient of research award from Pfizer and research subaward from CDC (via Catholic Charities)
- Thomas Talbot: Spouse receives research support from Sanofi Pasteur, Medimmune, and Gilead and serves on advisory committee for Novartis
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Appendix 2. Terms

A.2.1 Glossary of Terms

Healthcare organization (HCO) refers to a system comprised of people, facilities, and resources that deliver healthcare services to patients.

Healthcare personnel (HCP) refers to all paid and unpaid persons serving in healthcare settings who have the potential for direct or indirect exposure to patients or infectious materials, including body substances, contaminated medical supplies and equipment, contaminated environmental surfaces, or contaminated air. These HCP may include but are not limited to emergency medical service personnel, nurses, nursing assistants, physicians, technicians, therapists, phlebotomists, pharmacists, students and trainees, contractual staff not employed by the health care facility, and persons (e.g., clerical, dietary, environmental services, laundry, security, maintenance, engineering and facilities management, administrative, billing, and volunteer personnel) not directly involved in patient care but potentially exposed to infectious agents that can be transmitted among from HCP and patients. For this update, HCP does not include dental healthcare personnel, autopsy personnel, and laboratory personnel, as recommendations to address occupational infection prevention and control (IPC) services for these personnel are posted elsewhere.[1,2,3]

Healthcare settings refers to places where healthcare is delivered and includes, but is not limited to, acute care facilities, long term acute care facilities, inpatient rehabilitation facilities, nursing homes and assisted living facilities, home healthcare, vehicles where healthcare is delivered (e.g., mobile clinics), and outpatient facilities, such as dialysis centers, physician offices, and others.

Occupational health services (OHS) refers to formally organized plans that provide healthcare services for people at work.

Occupational infection prevention and control (IPC) services refers to a subset of services provided by occupational health services for preventing the transmission of infectious illnesses in the workplace.

Performance measures refer to objective, quantitative indicators of various aspects of the performance of a program. They can focus on different aspects of performance, such as effectiveness, efficiency, productivity, cost effectiveness, or customer satisfaction.[4]

Presenteeism refers to the act of attending work while ill and potentially infectious to others.

Quality improvement refers to a continuous and ongoing effort to achieve measurable improvements in the efficiency, effectiveness, performance, accountability, outcomes, and other indicators of quality in services.[5]

Safety culture of an organization refers to the product of individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization's health and safety management.[6]

Sick leave refers to absence from the workplace to address health needs, such as illness.

A.2.2 Acronyms and Abbreviations

Acronym	Expansion
ACIP	Advisory Committee on Immunization Practices
ADA	Americans with Disabilities Act
CDC	Centers for Disease Control and Prevention
CMS	Centers for Medicare & Medicaid Services
CoP	Conditions of Participation
EHR	Electronic Health Record
FDA	(United States) Food & Drug Administration
FMLA	Family Medical Leave Act
HCO	Healthcare Organization
HCP	Healthcare Personnel
HICPAC	Healthcare Infection Control Practices Advisory Committee
HIPAA	Health Insurance Portability and Accountability Act
HIV	Human Immunodeficiency Virus
IPC	Infection Prevention and Control
NHSN	National Healthcare Safety Network
NIOSH	National Institute for Occupational Safety and Health
OHS	Occupational Health Services
OSHA	Occupational Safety and Health Administration
PPE	Personal Protective Equipment
PPME	Pre-Placement Medical Evaluation
TB	Tuberculosis

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Appendix 3. Methods

This document is an update of two sections of the *Guideline for Infection Control in Healthcare Personnel, 1998*: *C. Infection Control Objectives for a Personnel Health Service* and *D. Elements of a Personnel Health Service for Infection Control.* The sections were updated by a Workgroup of the Healthcare Infection Control Practices Advisory Committee (HICPAC), including experts in occupational health, infectious diseases, and infection prevention and control (IPC). Updates were informed by a systematic review of recent articles published in peer-reviewed journals and databases of systematic reviews, guidelines, and regulations. All updates were vetted at public meetings of HICPAC (See Appendix 1).

A3.1 Literature Search Questions

The questions developed to guide the literature search were:

- What service elements are important for occupational health services that aim to prevent transmission of infections among healthcare personnel and patients in the US?
- What is known about implementing or delivering the following eight infection prevention and control elements of an occupational health service in the US?
    - Leadership and management
    - Communication and collaboration
    - Assessment and reduction of risks for infection among healthcare personnel populations
    - Medical evaluations
    - Occupational infection prevention and control education and training programs
    - Immunization programs
    - Management of potentially infectious exposures and illnesses
    - Management of healthcare personnel health records
- What interventions can improve the delivery or quality of one of the eight elements, or reduce transmission of infections among healthcare personnel and patients in the US?

A3.2 Literature Search

The infrastructure and delivery of healthcare to patients, and hence the provision of occupational IPC services to HCP, have changed since the publication of the *Guideline for Infection Control in Healthcare Personnel, 1998*. CDC (MD, KI, DK, AO, KR, DT) conducted a targeted literature search for recent articles consistent with current approaches in occupational IPC service delivery to HCP. Search strategies were formulated using a combination of Medical Subject Headings (MeSH) terms and key words to identify literature that focused on at least one of the eight OHS IPC elements. Four searches were performed in MEDLINE, EMBASE, and CINAHL, or the Cochrane Database of Systematic reviews.

Searches sought:

1. Articles published from January 2004 – October 2015 that were indexed in one of three databases (Table A3.1).
2. Articles published from January 2004 – December 2015 that were indexed in one of three databases using different key words (Table A3.2).

3. Meta-analyses and systematic reviews published from January 2004 – December 2015 that were indexed in the Cochrane Database of Systematic Reviews (Table A3.3).
4. Meta-analyses, systematic reviews, and narrative reviews about interventions to increase vaccination rates among HCP published from January 2004–December 2015 that were indexed in one of three databases (Table A3.4).

In addition to the results of the systematic review, CDC (KI, DK) searched relevant websites and systematic review repositories of government agencies and nongovernmental organizations (Table A3.5) for additional guidelines, regulations, program evaluations, quality improvement initiatives, and systematic reviews.

A3.3 Article Selection

CDC (MD, KI, DK, AO, KR, DT) conducted the title and abstract screening and the full text review using the below inclusion and exclusion criteria.

Inclusion Criteria: Articles were retrieved if they were:

- research studies, systematic and narrative reviews, meta-analyses, and other reports;
- relevant to an occupational health service element of interest; and
- relevant to prevention of transmission of infections among HCP or between HCP and patients.

Exclusion Criteria: Articles were excluded if they were:

- conference abstracts or unpublished academic dissertations;
- reports of OHS programs not related to HCP or related to dental practices, laboratory personnel, morgues, mortuaries, or in settings where healthcare is not provided; or
- non-US-based studies (except for systematic or narrative reviews on immunization programs).

Figure A3 depicts the process of screening and selecting articles. Very few relevant intervention studies were found in indexed databases, and many lacked well-defined interventions, a comparison group, large study size, or longitudinal follow-up.

A3.4 Draft Recommendation Formulation

The workgroup formulated draft recommendations based on current federal regulations, standards, and recommendations, or informed by:

- guidance of nongovernmental organizations;
- qualitative assessment of findings about interventions, service delivery, or quality from the indexed and non-indexed sources reviewed;
- workgroup professional experience and opinions regarding:
    - the benefits, harms, feasibility, and acceptability of interventions to HCO leaders, administrators, OHS staff, and HCP; and
    - the feasibility and applicability of interventions for diverse types of HCP and for varied service delivery models (e.g., provided on-site vs. off-site).

The workgroup classified all draft recommendations as good practice statements based on workgroup experience and scientific evidence that indicated a high probability that the recommended action would do more good than harm.[1]

A3.5 Reviewing and Finalizing the Guideline

Drafts of the updated sections and recommendations were presented at public HICPAC meetings in March 2016, July 2016, and December 2016. Input from HICPAC and the public were incorporated into subsequent drafts. The draft recommendations, their classification, and narrative were provisionally approved by HICPAC at the December 2016 meeting.[2] Following further revisions, CDC then submitted the guideline to CDC clearance and subsequent posting to the *Federal Register* for public comment. After this period of public comment, the comments will be reviewed at a HICPAC meeting, the draft guideline will be revised accordingly, and the final guideline will be submitted to CDC for final clearance. Once cleared, the final guideline will be posted to the CDC website.

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2. US Dept of Health and Human Services, Centers for Disease Control and Prevention. Record of the Proceedings, Healthcare Infection Control Practices Advisory Committee, December 1-2, 2016. https://www.cdc.gov/hicpac/pdf/archive/2016-December-HICPAC-meeting.pdf. Accessed June 12, 2018.

Table A3.1 First Search Strategy for Indexed Articles Published January 2004–October 2015, by Database

Search	Term	MEDLINE	EMBASE	CINAHL
1	Healthcare Personnel	949	1,162	479
2	Health Care Personnel	1,976	110,486	975
3	Healthcare Worker	808	1,002	2,944
4	Health Care Worker	1,085	1,323	4,526
5	exp Health Personnel/ or exp Personnel, Hospital/	396,129	952,375	-
6	1 or 2 or 3 or 4 or 5	399,062	954,578	8,664
7	occupational health	44,941	43,405	26,378
8	personnel health	83	79	50,840
9	occupational health objectives	2	2	74
10	7 or 8 or 9	45,021	43,476	75,197
11	6 and 10	6,040	9,015	4,397
12	preventive services	3,984	4,319	2,496
13	infection prevention	2,639	45,325	37,752
14	infection control	32,631	73,945	51,187
15	12 or 13 or 14	38,149	116,256	54,673
16	administration	1,005,772	1,239,293	280,074
17	coordination	77,795	83,464	6,986
18	16 or 17	1,080,888	1,319,751	286,157
19	6 and 10 and 18	575	359	658
20	medical evaluations	352	380	4,282
21	screening	429,687	654,641	69,955

Search	Term	MEDLINE	EMBASE	CINAHL
22	surveillance	160,830	179,458	25,725
23	laboratory tests	21,496	27,701	3,715
24	immuni*ation	137,580	120,244	17,972
25	vaccination	128,709	144,566	10,255
26	exp medical history taking/	19,050	179,580	89
27	20 or 21 or 22 or 23 or 24 or 25 or 26	830,485	1,204,613	120,859
28	6 and 10 and 27	621	1,060	1,031
29	staff education	1,188	1,840	4,795
30	exp inservice training/	25,343	11,054	76
31	29 or 30	26,365	12,818	4,869
32	6 and 15 and 31	298	257	26
33	immuni*ation program	1,625	1,700	3,560
34	vaccination program	2,303	2,642	982
35	immuni*ation policy	288	295	157
36	vaccination policy	618	665	238
37	33 or 34 or 35 or 36	4,609	5,037	4,417
38	6 and 37	344	644	265
39	postexposure management	55	60	37
40	occupational counseling	13	13	30
41	infection counseling	20	17	84
42	health counseling	496	519	1,100
43	disease exposure management	2	1	8
44	occupational exposure management	10	9	59
45	counseling services	819	856	834
46	39 or 40 or 41 or 42 or 43 or 44 or 45	1,384	1,445	1,980
47	6 and 46	153	400	56
48	employee health records	22	16	30
49	employee medical records	9	5	23
50	48 or 49	31	21	52
51	6 and 50	18	14	8
52	11 or 19 or 28 or 32 or 38 or 47 or 51	6,764	10,251	4,474
53	limit to 2014 to present	292	760	487
54	limit to english	266	718	480
55	limit to humans	250	709	273
56	Exclude MEDLINE	-	84	-
CINAHL	USA Only	-	-	177

Table A3.2 Second Search Strategy for Indexed Articles Published January 2004–December 2015, by Database

Search	Term	MEDLINE	EMBASE	CINAHL
1	Healthcare Personnel	916	1,177	449

Search	Term	MEDLINE	EMBASE	CINAHL
2	Health Care Personnel	1,964	112,789	966
3	Healthcare Worker	712	1,028	2,913
4	Health Care Worker	1,081	1,344	4,498
5	exp Health Personnel/ or exp Personnel, Hospital/	410,717	972,375	-
6	1 or 2 or 3 or 4 or 5	413,621	974,604	8,592
7	employee health	999	958	2,175
8	6 and 7	213	256	125
9	preventive services	3,941	4,364	2,470
10	infection prevention	2,607	45,757	37,934
11	infection control	30,986	74,936	51,389
12	9 or 10 or 11	36,452	117,631	54,825
13	administration	999,337	1,250,816	280,408
14	coordination	78,129	84,331	6,868
15	13 or 14	1,074,822	1,332,098	286,382
16	6 and 8 and 15	32	24	26
17	medical assessment	1,083	31,221	1,998
18	6 and 8 and 17	0	1	2
19	employee education	86	69	210
20	6 and 12 and 19	3	6	4
21	exposure management	114	149	326
22	communicable disease exposure management	1	1	2
23	21 or 22	114	149	326
24	6 and 23	41	66	26
25	healthcare hazard	3	4	58
26	health care hazard	4	3	111
27	infection control hazard	3	4	16
28	25 or 26 or 27	10	11	183
29	8 or 16 or 18 or 20 or 24 or 28	266	338	354
30	limit to 2004 to present	109	211	222
31	limit to english	100	204	213
32	limit to humans	99	186	118
33	Exclude MEDLINE	-	13	-
CINAHL	USA Only	-	-	67

Table A3.3 Third Search Strategy for Articles Published January 2004–December 2015 that were Indexed in Cochrane Database of Systematic Reviews

Search	Term	Results
1	"infection control":ti,ab,kw in Cochrane Reviews (Reviews and Protocols) and Other Reviews (Word variations have been searched)	82

Search	Term	Results
2	Infection Prevention:ti,ab,kw Publication Year from 2004 to 2015, in Cochrane Reviews (Reviews and Protocols) and Other Reviews (Word variations have been searched)	424
3	"health care worker":ti,ab,kw Publication Year from 2004 to 2015, in Cochrane Reviews (Reviews and Protocols) and Other Reviews (Word variations have been searched)	100
4	Health Care Personnel:ti,ab,kw Publication Year from 2004 to 2015, in Cochrane Reviews (Reviews and Protocols) and Other Reviews (Word variations have been searched)	162
5	Healthcare Worker:ti,ab,kw Publication Year from 2004 to 2015, in Cochrane Reviews (Reviews and Protocols) and Other Reviews (Word variations have been searched)	62
6	Healthcare Personnel:ti,ab,kw Publication Year from 2004 to 2015, in Cochrane Reviews (Reviews and Protocols) and Other Reviews (Word variations have been searched)	75
7	# 1 or #2	488
8	#3 or #4 or #5 or #6	284
9	#7 and #8	14
10	"occupational health":ti,ab,kw Publication Year from 2004 to 2015, in Cochrane Reviews (Reviews and Protocols) and Other Reviews (Word variations have been searched)	148
12	#8 and #10	19
13	Vaccination	185
14	Immunization	112
15	#13 or #14	251
16	#8 and #15	20

Table A3.4 Fourth Search Strategy for Indexed Articles about Immunization Programs for HCP Published January 2004–December 2015, by Database

Search	Term	MEDLINE	EMBASE	CINAHL
1	Healthcare Personnel	918	1,181	449
2	Health Care Personnel	1,964	113,015	966
3	Healthcare Worker	712	1,030	2,914
4	Health Care Worker	1,081	1,345	4,498
5	exp Health Personnel/ or exp Personnel, Hospital/	410,717	974,452	-
6	1 or 2 or 3 or 4 or 5	413,623	976,685	8,593
7	immuni*ation	136,878	121,011	17,990
8	vaccination	130,963	146,145	10,179
9	7 or 8	229,682	226,581	22,537
10	6 and 9	4,657	14,067	865
11	occupational health	45,354	43,292	26,379
12	employee health	999	959	2,175

Search	Term	MEDLINE	EMBASE	CINAHL
13	personnel health	81	79	3,402
14	11 or 12 or 13	45,922	43,960	30,919
15	6 and 9 and 14	308	489	182
16	limit 15 to (meta analysis or "review")	24	72	10
17	limit to 2004 to 2015	16	50	7
18	limit to english	13	46	7
19	limit to humans	13	45	-
20	Exclude MEDLINE	-	6	-
CINAHL	USA Only	-	-	6

1309 **Table A3.5 Websites Examined for Government Regulations, Standards, Guidelines, and Other**
1310 **Reports about Occupational Infection Prevention and Control among Healthcare Personnel**

Agency/Group	Website(s)
Agency for Healthcare Research and Quality (AHRQ)	Agency for Healthcare Research and Quality (http://www.ahrq.gov)
Centers for Disease Control and Prevention (CDC)	Bernstein AB. Health care in America: Trends in utilization. Hyattsville, Maryland: National Center for Health Statistics. 2003. (https://www.cdc.gov/nchs/data/misc/healthcare.pdf) Biosafety in Microbiological and Biomedical Laboratories. (https://www.cdc.gov/biosafety/publications/bmbl5/) Viral Hepatitis. Hepatitis B Questions and Answers for Health Professionals (https://www.cdc.gov/hepatitis/hbv/hbvfaq.htm) Viral Hepatitis. Hepatitis C Questions and Answers for Health Professionals. (https://www.cdc.gov/hepatitis/hcv/hcvfaq.htm) Notes on the Interim U.S. Guidance for Monitoring and Movement of Persons with Potential Ebola Virus Exposure. (https://www.cdc.gov/vhf/ebola/exposure/monitoring-and-movement-of-persons-with-exposure.html) Advisory Committee on Immunization Practices (ACIP). (https://www.cdc.gov/vaccines/acip/) Vaccine Recommendations and Guidelines of the ACIP. (http://www.cdc.gov/vaccines/hcp/acip-recs/index.html) Vaccine Storage and Handling Toolkit. Healthcare Providers/Professionals. Updated: January 2, 2018. (https://www.cdc.gov/vaccines/hcp/admin/storage/toolkit/index.html)

Agency/Group	Website(s)
	Guidance on Personal Protective Equipment (PPE) To Be Used By Healthcare Workers during Management of Patients with Confirmed Ebola or Persons under Investigation (PUIs) for Ebola who are Clinically Unstable or Have Bleeding, Vomiting, or Diarrhea in U.S. Hospitals, Including Procedures for Donning and Doffing PPE. (https://www.cdc.gov/vhf/ebola/healthcare-us/ppe/guidance.html) National Healthcare Safety Network (NHSN) 2015. (http://www.cdc.gov/nhsn/index.html) National Healthcare Safety Network (NHSN). CMS Requirements, CMS Resources for NHSN Users. Updated June 1, 2018. (https://www.cdc.gov/nhsn/cms/index.html) The National Institute for Occupational Safety and Health (NIOSH). Hierarchy of Controls. Updated: July 18, 2016. (http://www.cdc.gov/niosh/topics/hierarchy/default.html) National Notifiable Diseases Surveillance System (NNDSS). (https://wwwn.cdc.gov/nndss/) National Surveillance System for Healthcare Workers (NaSH). Summary report for blood and body fluid exposure data collected from participating healthcare facilities (June 1995 through December 2007). United States Department of Health & Human Services. (http://www.cdc.gov/nhsn/PDFs/NaSH/NaSH-Report-6-2011.pdf) Healthcare Infection Control Practices Advisory Committee. (https://www.cdc.gov/hicpac/) Siegel JD, Rhinehart E, Jackson M, Chiarello L, and the Healthcare Infection Control Practices Advisory Committee. 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings. (https://www.cdc.gov/infectioncontrol/pdf/guidelines/isolation-guidelines.pdf) The Community Guide. Interventions to Promote Seasonal Influenza Vaccinations Using Interventions with On-site, Free, Actively Promoted Vaccinations among Healthcare Workers. 2008. (http://www.thecommunityguide.org/worksite/flu-hcw.html)
Centers for Medicare & Medicaid Services (CMS)	Conditions for Coverage (CfCs) & Conditions of Participations (CoPs). (https://www.cms.gov/Regulations-and-Guidance/Legislation/CFCsAndCoPs/index.html) State Operations Manual, Appendix A - Survey Protocol, Regulations and Interpretive Guidelines for Hospitals. U.S. Department of Health & Human Services. Released May 21, 2004. Updated November 20, 2015. (https://www.cms.gov/Regulations-and-Guidance/Guidance/Manuals/Downloads/som107ap_a_hospitals.pdf)

Agency/Group	Website(s)
	42 CFR Parts 410, 411, 416 et al. Medicare and Medicaid Programs: Hospital Outpatient Prospective Payment; Ambulatory Surgical Center Payment; Hospital Value-Based Purchasing Program; Physician Self- Referral; and Patient Notification Requirements in Provider Agreements; Final Rule. Department of Health & Human Services. 2011: Federal Register. (https://www.gpo.gov/fdsys/pkg/FR-2011-11-30/pdf/2011-28612.pdf)
Occupational Safety and Health Administration (OSHA)	Hazard Identification Training Tool. (https://www.osha.gov/hazfinder/index.html) Hospital eTool: Administration. 2016. (https://www.osha.gov/SLTC/etools/hospital/admin/admin.html) eTools, eMatrix, Expert Advisors and v-Tools, 2016. (https://www.osha.gov/dts/osta/oshasoft/index.html) OSHA Forms for Recording Work-Related Injuries and Illnesses. (https://www.osha.gov/recordkeeping/osha-rkforms-winstr_fillable.pdf) Recording and Reporting Occupational Injuries and Illnesses (Part No. 1904). (https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9631) Respiratory Protection (standard no.1910.134). Personal Protective Equipment, Occupational Safety and Health Standards. (https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=12716&p_table=STANDARDS) Respiratory Protection (standard no. 1910.132). General Requirements. (https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9777&p_text_version=FALSE) Hazard Communication (standard no. 1910.1200). Toxic and Hazardous Substances. Occupational Safety and Health Standards. 2012. (https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=10099) Bloodborne pathogens (standard no. 1910.1030). Toxic and Hazardous Substances. Occupational Safety and Health Standards. (https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=10051)
US Congress	Public Law 104–191, Health Insurance Portability and Accountability Act of 1996. 104th Congress. (http://library.clerk.house.gov/reference-files/PPL_HIPAA_HealthInsurancePortabilityAccountabilityAct_1996.pdf)

Agency/Group	Website(s)
	Public Law 111-87, Ryan White HIV/AIDS Treatment Extension Act of 2009. 111th Congress. (http://www.cdc.gov/niosh/topics/ryanwhite/pdfs/RyanWhiteActof2009.pdf)
US Department of Justice (DOJ)	Information and Technical Assistance on the Americans with Disabilities Act. (https://www.ada.gov/ta-pubs-pg2.htm) Americans with Disabilities Act Compliance. (http://www.ada-compliance.com/)
US Department of Labor (DoL)	Wage and Hour Division website. Family and Medical Leave Act. (http://www.dol.gov/whd/fmla/)
US Food & Drug Administration (FDA)	U.S. Food & Drug Administration. (http://www.fda.gov) MedWatch: The FDA Safety Information and Adverse Event Reporting Program. (http:/www.fda.gov/Safety/MedWatch/)
Private Organizations/ Professional Societies	American College of Occupational and Environmental Medicine (ACOEM). (http://www.acoem.org/) American Society for Healthcare Engineering (ASHE). (www.ashe.org) Association for Professionals in Infection Control and Epidemiology (APIC). (http://www.apic.org/) Council of State and Territorial Epidemiologists (CSTE). (www.cste.org) Infectious Diseases Society of America (IDSA). (http://www.idsociety.org/Index.aspx) IDSA and the American Association for the Study of Liver Diseases (AASLD) HCV Guidance: Recommendations for Testing, Managing, and Treating Hepatitis C. (http://www.hcvguidelines.org/) National Quality Forum (NQF). (http://www.qualityforum.org) NQF National Voluntary Consensus Standards for Influenza and Pneumococcal Immunizations. (http://www.qualityforum.org/Publications/2008/12/National_Voluntary_Consensus_Standards_for_Influenza_and_Pneumococcal_Immunizations.aspx) Society for Healthcare Epidemiology of America (SHEA) (https://www.shea-online.org/) The Joint Commission. Standard IC.02.04.01 Influenza Vaccination for Licensed Independent Practitioners and Staff (HAP, CAH, LTC). December 2, 2011. (https://www.jointcommission.org/ic020401_cah_hap_ltc/) The Joint Commission. Joint Commission on Accreditation of Healthcare Organizations, New infection control requirement for offering influenza vaccination to

Agency/Group	Website(s)
	staff and licensed independent practitioners, Joint Commission Perspectives, 26 (2006) 10-11. (https://www.health.ny.gov/prevention/immunization/toolkits/docs/joint_commission_standard.pdf) University of California, San Francisco. Clinician Consultation Center. Clinician Consultation, 2017. (http://nccc.ucsf.edu/)
International Sources	Health Canada. Trends in Workplace Injuries, Illnesses, and Policies in Healthcare across Canada. Office of Nursing Policy. (http://www.hc-sc.gc.ca/hcs-sss/pubs/hhrhs/2004-hwi-ipsmt/index-eng.php) Public Health Agency of Canada. Infection Control Guideline Series. Nosocomial and Occupational Infections. (http://www.phac-aspc.gc.ca/nois-sinp/guide/pubs-eng.php) Scottish Intercollegiate Guidelines Network. (http://www.sign.ac.uk/our-guidelines.html)

1311

Figure A3. Results of the Process to Select Relevant Articles