Guideline for Post-Exposure Prophylaxis Among Healthcare Workers

Acknowledgements

We would like to acknowledge the Infection Control Guidelines Committee for developing these guidelines.

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1. List of Abbreviations

- ~~**HBs:** Hepatitis B Surface~~
- **anti-HBc:** Total antibody to hepatitis B core antigen
- **anti-HBs**: Anti-hepatitis B surface antibody
- **ARV:** Antiretroviral
- **B. pertussis:** *Bordetella pertussis*
- **CDC:** Centers for Disease Control and Prevention
- **CMV:** Cytomegalovirus
- **DNA:** Deoxyribonucleic Acid
- **EMI:** Emergency Management of Injuries
- **HAIs:** Healthcare-Associated Infections
- **HBIG:** Hepatitis B Immune Globulin
- **HBsAg:** Hepatitis B Surface Antigen
- **HBV:** Hepatitis B Virus
- **HCP:** Healthcare Personnel
- **HCV:** Hepatitis C Virus
- **HIV:** Human Immunodeficiency Virus
- **KPIs:** Key Performance Indicators
- **MMR:** Measles, Mumps, and Rubella
- **N. meningitidis:** *Neisseria meningitidis*
- **NSIs:** Needlestick Injuries
- **OPIM:** Other Potentially Infectious Materials
- **PEP:** Post-Exposure Prophylaxis
- **PPE:** Personal Protective Equipment
- **RIG**: Rabies immunoglobulin
- **RNA:** Ribonucleic Acid
- **Tdap:** Tetanus, Diphtheria, and Pertussis
- **TIG:** Tetanus Immune Globulin
- **VariZIG:** Varicella-zoster immune globulin
- **VZV:** Varicella-Zoster Virus
- **WHO:** World Health Organization

2. Glossary

- **Immunization:** The process or procedure by which a subject is rendered immune, or resistant to a specific disease. This term is often used interchangeably with vaccination or inoculation, although the act of inoculation/vaccination does not always result in immunity.
- **Occupational exposure:** A reasonably anticipated skin, eye, mucous membrane, or parenteral contact with blood or other potentially infectious materials that may result from the performance of an employee's duties.
- **Post-exposure prophylaxis:** The administration of medications following exposure to a disease to prevent infection.

3. Executive Summary

Healthcare Personnel (HCP) are at increased risk of acquiring infections due to their frequent exposure to pathogens in the healthcare setting. These infections can range from minor skin infections to serious illnesses like hepatitis and tuberculosis.

By implementing effective infection prevention and control measures, including immunization and post exposure prophylaxis, healthcare facilities can significantly reduce the risk of infections among HCP and create a safer environment for everyone.

Recommendations
Immunization of Healthcare Personnel For healthcare personnel, immunization against certain diseases is recommended to prevent infections, protect patients, and ensure a safe healthcare environment. Specific recommendations are tailored to the individual's role, exposure risk, and vaccination history. ● **Hepatitis B:** for all healthcare personnel due to the risk of exposure to blood and body fluids. ● **Influenza:** Annual vaccination is crucial especially in settings with vulnerable populations. ● **Measles, Mumps, and Rubella (MMR):** For HCP without documented or presumptive evidence of immunity. ● **Varicella (Chickenpox):** For HCP without documented or other evidence of immunity. ● **Meningococcal Disease:** For those at increased risk of exposure. ● **Other Vaccines:** According to individual occupational and clinical risk assessment **(Strong Recommendation)**
Human Immunodeficiency Virus (HIV) Post Exposure Prophylaxis (PEP) is recommended following a high-risk occupational exposure (sharps or mucosal splash) **(Strong Recommendation)**
We advise against HIV PEP where there is no or negligible risk of HIV transmission (e.g: Through intact skin that comes in contact with HIV infected or other body fluids **(Strong Recommendation)**
Post-exposure prophylaxis offered as early as possible, to individuals with suspected or known exposure to HIV, ideally within 24 hours but not later than 72 hours. **(Strong Recommendation)**
An HIV PEP regimen with two ARV drugs is effective, but three drugs are preferred **(Conditional Recommendation)**
A 28-day prescription of antiretroviral drugs should be provided for HIV post-exposure prophylaxis **(Strong Recommendation)**

For HCP with written documentation of a complete hepatitis B vaccination series and a documented anti-HBs level of **≥10 mIU/mL**, no HBV post-exposure prophylaxis is necessary, regardless of the source patient's HBsAg status **(Strong Recommendation)**
For vaccinated HCP with written documentation of a complete hepatitis B vaccination series but without previous anti-HBs testing, the HCP should be tested for anti-HBs and the source patient should be tested for HBsAg within 24 hrs after exposure **(Strong Recommendation)**
If anti-HBs is **<10 mIU/mL** and the source patient is HBsAg-positive or has unknown HBsAg status, the HCP should receive **one dose of HBIG and be revaccinated as soon as possible**. HepB vaccine may be administered simultaneously with HBIG but at a different anatomical site **(Strong Recommendation)**
If anti-HBs is **<10 mIU/mL** and the source patient is HBsAg-negative, the HCP should receive one additional HepB vaccine dose followed by repeat anti-HBs testing 1–2 months later. If anti-HBs remains <10 mIU/mL, the HCP should complete a second vaccine series and undergo repeat anti-HBs testing 1–2 months after the final dose **(Strong Recommendation)**
If the source patient is HBsAg-negative, the HCP should complete the HepB vaccine series according to the recommended schedule **(Strong Recommendation)**
For HCP with anti-HBs <10 mIU/mL after two complete hepatitis B vaccine series, if the source patient is HBsAg-positive or has unknown HBsAg status, the HCP should receive **two doses of HBIG**, with the first dose administered as soon as possible after exposure and the second dose 1 month later. HepB vaccine is not indicated **(Strong Recommendation)**
Give hepatitis B vaccination within 7 days and ideally within 48 hours of exposure as it is highly effective in preventing HBV infection after exposure **(Strong Recommendation)**
If HBIG is required, it should ideally be given within 48 hours of exposure, but not later than one week after exposure **(Strong Recommendation)**
Prompt administration of PEP is essential for optimal effectiveness. Ideally, both the vaccine and HBIG should be given within 48 hours of exposure **(Strong Recommendation)**
Post-vaccination testing anti hepatitis B surface (anti-HBs) should be performed to confirm immunity in those who received the vaccine **(Strong Recommendation)**
Individuals who do not develop adequate anti-HBs levels after the primary vaccine series should be evaluated and may require a second vaccine series **(Strong Recommendation)**

Hepatitis C virus (HCV) antibody or HCV ribonucleic acid (RNA) test should be carried out on the recipient at six weeks, 12 weeks and six months after the exposure incident **(Strong Recommendation)**
Tetanus Immunoglobulin (TIG) is recommended as post-exposure prophylaxis for those with tetanus prone wounds based on a risk assessment for who meet the following criteria: • Not adequately vaccinated or immunization status not known • Are immunocompromised, even if fully immunized. If both TIG plus a vaccine are to be given, administer at separate sites **(Strong Recommendation)**
For healthcare personnel (HCP) exposed to diphtheria, regardless of vaccination status, the recommendation is to administer PEP, exclude them from work, and obtain both nasal and pharyngeal swabs for diphtheria culture. If cultures are negative, they can return to work while completing antibiotic therapy. **(Strong Recommendation)**
For HCP with presumptive evidence of measles immunity, PEP and work restrictions are not necessary after exposure to measles. Presumptive evidence of immunity includes documented vaccination with two doses of Measles, mumps and rubella (MMR) vaccine, laboratory evidence of immunity, or laboratory confirmation of past measles infection. **(Strong Recommendation)**
For asymptomatic HCP with presumptive evidence of mumps immunity exposed to mumps, work restrictions are not necessary, but daily monitoring for symptoms is recommended. Specifically, this monitoring should occur from the 10th day after their first exposure through the 25th day after their last exposure. **(Strong Recommendation)**
For asymptomatic healthcare personnel with presumptive evidence of rubella immunity exposed to rubella, work restrictions are not necessary. Instead, daily monitoring for signs and symptoms of rubella should be implemented from the 7th day after the first exposure through the 23rd day after the last exposure. **(Strong Recommendation)**
for HCP regarding Neisseria meningitidis exposures, administer antimicrobial prophylaxis regardless of vaccination status after exposure, exclude those with invasive disease from work until 24 hours after proper antimicrobial therapy, and no work restrictions for those with nasopharyngeal carriage. **(Strong Recommendation)**
For asymptomatic HCP exposed to pertussis, or who are likely to interact with people at increased risk for severe pertussis, PEP with antibiotics is recommended, or if not receiving PEP, they should be restricted from contact with vulnerable patients for 21 days after exposure. **(Strong Recommendation)**
The recommendations for HCP with rabies virus exposure involve administering PEP **(Strong Recommendation)**

Work restrictions are not necessary for asymptomatic HCP. However, HCP with suspected or confirmed rabies should be excluded from work, in consultation with public health authorities. **(Strong Recommendation)**
For asymptomatic HCP with documented immunity to varicella, post-exposure prophylaxis and work restrictions are not necessary after exposure to varicella or herpes zoster **(Strong Recommendation)**
These individuals should ensure they are up-to-date with their varicella vaccinations, receiving a second dose if only one dose has been documented, within 3-5 days of exposure if 4 weeks have passed since the first dose **(Strong Recommendation)**
Implement daily monitoring for signs and symptoms of varicella from the 8th day after the first exposure through the 21st day after the last exposure **(Strong Recommendation)**
For asymptomatic healthcare personnel exposed to varicella or herpes zoster, without evidence of immunity, PEP and work exclusion should be from the 8th day after the first exposure through the 21st day after the last exposure. **(Strong Recommendation)**
For HCP with varicella (chickenpox), exclude from work until all lesions have dried and crusted, or, for those with non-vesicular lesions, until no new lesions appear within a 24-hour period **(Strong Recommendation)**
Do not routinely exclude healthcare personnel only on the basis of their pregnancy or intent to be pregnant from the care of patients with infections that have potential to harm the fetus (e.g., Cytomegalovirus (CMV), Human Immunodeficiency Virus (HIV), viral hepatitis, herpes simplex, parvovirus, rubella, varicella); Any work restriction should be based on the specific occupational exposure risk (**Strong Recommendation)**

4. Introduction

Crucial guidelines for healthcare personnel to prevent the transmission of bloodborne pathogens, most notably HIV, after an occupational exposure. This typically involves percutaneous injuries (like needle stick injuries) or mucocutaneous exposure to blood or other potentially infectious materials.

The cornerstone of PEP is timeliness: it must be initiated as soon as possible, ideally within hours of exposure and no later than 72 hours to be effective. Every hour counts in reducing the risk of seroconversion.

A comprehensive PEP guideline encompasses several key aspects:

1. **Immediate First Aid:** This includes washing the exposed area thoroughly with soap and water for skin injuries. For mucous membrane exposure (eyes, nose, mouth), copious irrigation with water or sterile saline is essential. Importantly, the wound should not be squeezed or scrubbed vigorously.
2. **Reporting the Exposure:** A clear and accessible system for reporting occupational exposures must be in place. This allows for prompt evaluation and initiation of PEP. The report should document details of the exposure, including the date, time, type of exposure, body fluid involved, and information about the source patient if known.
3. **Risk Assessment:** Evaluating the risk of transmission involves considering factors such as:
    - The pathogen involved (HIV, Hepatitis B, Hepatitis C).
    - The type and volume of the body fluid.
    - The route and severity of the exposure (e.g., deep intramuscular needlestick versus a superficial skin splash).
    - The source patient's infection status and viral load if known.
4. **Source Patient Evaluation (if possible):** Testing the source patient for relevant bloodborne pathogens (HIV, HBV, HCV) is crucial for guiding PEP decisions. Consent for testing should be obtained. If the source patient is known to be positive for a bloodborne pathogen.
5. **Baseline Testing of the Exposed Healthcare personnel:** Blood samples should be collected from the exposed staff member for baseline testing of HIV, HBV surface antigen and antibody, and HCV antibody. This helps to document their pre-exposure status.
6. **Post-Exposure Prophylaxis Regimen:** If indicated based on the risk assessment and source patient's status, a course of antiretroviral drugs for HIV PEP should be initiated immediately. Current guidelines generally recommend a 28-day course of

a multi-drug regimen. The specific drugs used may vary based on local guidelines and the potential for drug resistance. For Hepatitis B, PEP may involve Hepatitis B immunoglobulin (HBIG) and/or vaccination depending on the exposed individual's vaccination status and response. There is generally no recommended PEP for Hepatitis C, but follow-up testing is crucial.

7. **Counselling and Education:** The exposed healthcare personnel should receive counselling about the risk of transmission, the importance of PEP adherence, potential side effects of the medications, and the need for follow-up testing. Education on safe work practices and universal precautions to prevent future exposures is also essential.
8. **Follow-up Testing:** The exposed healthcare personnel will need follow-up blood tests at specific intervals (e.g., 6 weeks, 3 months, and sometimes 6 months post-exposure) to monitor for seroconversion.
9. **Documentation and Confidentiality:** All aspects of the exposure, evaluation, treatment, and follow-up must be carefully documented in the exposed staff member's confidential medical record.
10. **Accessibility of PEP:** Healthcare facilities must ensure that PEP medications are always readily available, including outside of regular working hours (e.g., in emergency departments). Clear protocols should outline how to access PEP promptly.

5. Scope and Purpose

This **Post-Exposure Prophylaxis among Healthcare personnel Guideline** outlines procedures for managing occupational exposures among healthcare personnel to blood and other potentially infectious materials (OPIM) to minimize the risk of transmission of bloodborne pathogens, specifically Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), and Hepatitis C Virus (HCV).

The scope of this guideline applies to all healthcare personnel and covers occupational exposures that pose a risk of bloodborne pathogen transmission, including:

- **Percutaneous injuries:** Needlestick injuries and cuts from sharps, including scalpels and broken glass.
- **Mucocutaneous exposures:** Splashes or contact of blood or OPIM with the eyes, nose, or mouth.
- **Non-intact skin exposures:** Contact of blood or OPIM with skin that is chapped, abraded, or affected by dermatitis.

These guidelines address immediate management, risk assessment, PEP administration, follow-up care, and preventive strategies related to occupational exposures.

The **purpose** of this guideline is to establish a standardized, evidence-based approach for the timely management of occupational exposures to bloodborne pathogens, including HIV, HBV, and HCV, among healthcare staff. This guideline aims to minimize the risk of infection through prompt initiation of appropriate PEP, medical evaluation, counselling, and follow-up.

Target Audience

- Physicians
- Nurses
- Medical technicians
- Laboratory personnel
- Dentists and dental hygienists
- Emergency medical services personnel
- Students and trainees in healthcare settings
- Support staff involved in handling potentially contaminated materials

6. Methodology

A comprehensive search for guidelines was undertaken to identify the most relevant guidelines to consider for adaptation.
Inclusion/ exclusion criteria followed in the search and retrieval of guidelines to be adapted:

- Selecting only evidence-based guidelines (guideline must include a report on systematic literature searches and explicit links between individual recommendations and their supporting evidence)
- Selecting only national and/or international guidelines
- Specific range of dates for publication (using Guidelines published or updated within the last 3 years)
- Selecting peer reviewed publications only
- Selecting guidelines written in English language
- Excluding guidelines written by a single author, not on behalf of an organization to be valid and comprehensive, a guideline ideally requires multidisciplinary input.
- Excluding guidelines published without references as the panel needs to know whether a thorough literature review was conducted and whether current evidence was used in the preparation of the recommendations.

The following characteristics of the retrieved guidelines were summarized in:

- Developing organization/authors
- Date of publication, posting, and release
- Country/language of publication
- Date of posting and/or release
- Dates of the search used by the source guideline developers.

All retrieved Guidelines were screened and appraised using AGREE II instrument (www.agreetrust.org) by at least three members. The panel decided on a cut-off point or ranked the guidelines (any guideline scoring above 50% on the rigor dimension was retained). The committee decided to adapt from:

1. Centers for Disease Control and Prevention (CDC). Clinical guidance for wound management to prevent tetanus. Jan 2025[(1)]
2. Centers for Disease Control and Prevention (CDC). Infection Control in Healthcare Personnel: Epidemiology and Control of Selected Infections Transmitted Among Healthcare Personnel and Patients. 2024 [(2)]
3. Health Protection Surveillance Centre (HPSC). Guidelines for the Emergency Management of Injuries (EMI) and Post-Exposure Prophylaxis (PEP). 2024 [(4)]

Evidence assessment

According to World Health Organization (WHO) Handbook for Guidelines, we used the GRADE (Grading of Recommendations, Assessment, Development and Evaluation) approach to assess the quality of a body of evidence, develop and report recommendations. GRADE methods are used by WHO because these represent internationally agreed standards for making transparent recommendations. Detailed GRADE information is available on the following sites:

- GRADE GRADE working group: https://www.gradeworkinggroup.org/
- GRADE online training modules: http://cebgrade.mcmaster.ca/

Table (1) Quality and Significance of the four levels of evidence in GRADE

Quality	Definition	Implications
High	The guideline development group is very confident that the true effect lies close to that of the estimate of the effect	Further research is very unlikely to change confidence in the estimate effect
Moderate	The guideline development group is moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibly that it is substantially different	Further research is likely to have an important impact on confidence in the estimate of the effect and may change the estimate
Low	Confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the true effect	Further research is very likely to have an important on confidence in the estimate of effect and is unlikely to change the estimate
Very low	The group has very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of the effect	Any estimate of the effect is very uncertain

Table (2) Factors that determine How to upgrade or downgrade the quality of evidence.

Downgrade in presence of	Upgrade in presence of
Study limitations. **1-** Serious limitations **2-** Very serious limitations	Dose- response gradient. +1 Evidence of a dose-response gradient
Consistency **1-** Important inconsistency	Direction of plausible bias + All plausible confounders would have reduced the effect
Directness **1-** Some uncertainty **2-** Major uncertainty	Magnitude of the effect +1 Strong, no plausible Confounder, consistent and direct evidence
Precision **1-** Imprecise data	+2 very strong, no major threats to validity and direct evidence
Reporting bias **1.** High probability of reporting bias	

The strength of the recommendations

The strength of a recommendation communicates the importance of adherence to the recommendation.

- **Strong recommendations**

With strong recommendations, the guideline communicates the message that the desirable effects of adherence to the recommendation outweigh the undesirable effects. This means that in most situations the recommendation can be adopted as policy.

- **Conditional recommendations**

These are made when there is greater uncertainty about the four factors above or if local adaptation has to account for a greater variety in values and preferences, or when resource use makes the intervention suitable for some, but not for other locations. This means that there is a need for substantial debate and involvement of stakeholders before this recommendation can be adopted as policy.

When not to make recommendations?

When there is lack of evidence on the effectiveness of an intervention, it may be appropriate not to make a recommendation.

7. Recommendations

Immunization of Healthcare Personnel

For healthcare personnel, immunization against certain diseases is recommended to prevent infections, protect patients, and ensure a safe healthcare environment. Specific recommendations are tailored to the individual's role, exposure risk, and vaccination history.

- **Hepatitis B:** for all healthcare personnel due to the risk of exposure to blood and body fluids.
- **Influenza:** Annual vaccination is crucial especially in settings with vulnerable populations.
- **Measles, Mumps, and Rubella (MMR):** For HCP without documented or presumptive evidence of immunity.
- **Varicella (Chickenpox):** For HCP without documented or other evidence of immunity.
- **Meningococcal Disease:** For those at increased risk of exposure.
- **Other Vaccines:** According to individual occupational and clinical risk assessment **(Strong Recommendation, High Grade Evidence)**

Human Immunodeficiency Virus (HIV) Post Exposure Prophylaxis (PEP) is recommended following a high-risk occupational exposure (sharps or mucosal splash) **(Strong Recommendation, Low Grade Evidence)**
We advise against HIV PEP where there is no or negligible risk of HIV transmission (e.g: Through intact skin that comes in contact with HIV infected or other body fluids **(Strong Recommendation, Low Grade Evidence)**
Post-exposure prophylaxis offered as early as possible, to individuals with suspected or known exposure to HIV, ideally within 24 hours but not later than 72 hours. **(Strong Recommendation, Low Grade Evidence)**
An HIV PEP regimen with two ARV drugs is effective, but three drugs are preferred **(Conditional Recommendation, Low Grade Evidence)**
A 28-day prescription of antiretroviral drugs should be provided for HIV post-exposure prophylaxis **(Strong Recommendation, High Grade Evidence)**
For HCP with written documentation of a complete hepatitis B vaccination series and a documented anti-HBs level of **≥10 mIU/mL**, no HBV post-exposure prophylaxis is necessary, regardless of the source patient's HBsAg status **(Strong Recommendation, Moderate Grade Evidence)**
For vaccinated HCP with written documentation of a complete hepatitis B vaccination series but without previous anti-HBs testing, the HCP should be tested for anti-HBs and the source patient should be tested for HBsAg within 24 hrs after exposure **(Strong Recommendation, Moderate Grade Evidence)**
If anti-HBs is **<10 mIU/mL** and the source patient is HBsAg-positive or has unknown HBsAg status, the HCP should receive **one dose of HBIG and be revaccinated as soon as possible**. HepB vaccine may be administered simultaneously with HBIG but at a different anatomical site **(Strong Recommendation, Moderate Grade Evidence)**
If anti-HBs is **<10 mIU/mL** and the source patient is HBsAg-negative, the HCP should receive one additional HepB vaccine dose followed by repeat anti-HBs testing 1–2 months later. If anti-HBs remains <10 mIU/mL, the HCP should complete a second vaccine series and undergo repeat anti-HBs testing 1–2 months after the final dose **(Strong Recommendation, Moderate Grade Evidence)**
If the source patient is HBsAg-negative, the HCP should complete the HepB vaccine series according to the recommended schedule **(Strong Recommendation, Moderate Grade Evidence)**

For HCP with anti-HBs <10 mIU/mL after two complete hepatitis B vaccine series, if the source patient is HBsAg-positive or has unknown HBsAg status, the HCP should receive **two doses of HBIG**, with the first dose administered as soon as possible after exposure and the second dose 1 month later. HepB vaccine is not indicated **(Strong Recommendation, Moderate Grade Evidence)**
Give hepatitis B vaccination within 7 days and ideally within 48 hours of exposure as it is highly effective in preventing HBV infection after exposure **(Strong Recommendation, Moderate Grade Evidence)**
If HBIG is required, it should ideally be given within 48 hours of exposure, but not later than one week after exposure **(Strong Recommendation, Moderate Grade Evidence)**
Prompt administration of PEP is essential for optimal effectiveness. Ideally, both the vaccine and HBIG should be given within 48 hours of exposure **(Strong Recommendation, Moderate Grade Evidence)**
Post-vaccination testing anti hepatitis B surface (anti-HBs) should be performed to confirm immunity in those who received the vaccine **(Strong Recommendation, Moderate Grade Evidence)**
Individuals who do not develop adequate anti-HBs levels after the primary vaccine series should be evaluated and may require a second vaccine series **(Strong Recommendation, Moderate Grade Evidence)**
Hepatitis C virus (HCV) antibody or HCV ribonucleic acid (RNA) test should be carried out on the recipient at six weeks, 12 weeks and six months after the exposure incident **(Strong Recommendation, Moderate Grade Evidence)**
Tetanus Immunoglobulin (TIG) is recommended as post-exposure prophylaxis for those with tetanus prone wounds based on a risk assessment for who meet the following criteria: • Not adequately vaccinated or immunization status not known • Are immunocompromised, even if fully immunized. If both TIG plus a vaccine are to be given, administer at separate sites **(Strong Recommendation, Moderate Grade Evidence)**
For healthcare personnel (HCP) exposed to diphtheria, regardless of vaccination status, the recommendation is to administer PEP, exclude them from work, and obtain both nasal and pharyngeal swabs for diphtheria culture. If cultures are negative, they

can return to work while completing antibiotic therapy. **(Strong Recommendation, High Grade Evidence)**
For HCP with presumptive evidence of measles immunity, PEP and work restrictions are not necessary after exposure to measles. Presumptive evidence of immunity includes documented vaccination with two doses of Measles, mumps and rubella (MMR) vaccine, laboratory evidence of immunity, or laboratory confirmation of past measles infection. **(Strong Recommendation, Moderate Grade Evidence)**
For asymptomatic HCP with presumptive evidence of mumps immunity exposed to mumps, work restrictions are not necessary, but daily monitoring for symptoms is recommended. Specifically, this monitoring should occur from the 10th day after their first exposure through the 25th day after their last exposure. **(Strong Recommendation, Moderate Grade Evidence)**
For asymptomatic healthcare personnel with presumptive evidence of rubella immunity exposed to rubella, work restrictions are not necessary. Instead, daily monitoring for signs and symptoms of rubella should be implemented from the 7th day after the first exposure through the 23rd day after the last exposure. **(Strong Recommendation, Low Garde Evidence)**
for HCP regarding Neisseria meningitidis exposures, administer antimicrobial prophylaxis regardless of vaccination status after exposure, exclude those with invasive disease from work until 24 hours after proper antimicrobial therapy, and no work restrictions for those with nasopharyngeal carriage. **(Strong Recommendation, High Garde Evidence)**
For asymptomatic HCP exposed to pertussis, or who are likely to interact with people at increased risk for severe pertussis, PEP with antibiotics is recommended, or if not receiving PEP, they should be restricted from contact with vulnerable patients for 21 days after exposure **(Strong Recommendation, Moderate Grade Evidence)**
The recommendations for HCP with rabies virus exposure involve administering PEP **(Strong Recommendation, High Garde Evidence)**
Work restrictions are not necessary for asymptomatic HCP. However, HCP with suspected or confirmed rabies should be excluded from work, in consultation with public health authorities. **(Strong Recommendation, Low Garde Evidence)**
For asymptomatic HCP with documented immunity to varicella, post-exposure prophylaxis and work restrictions are not necessary after exposure to varicella or herpes zoster **(Strong Recommendation, High Grade Evidence)**

These individuals should ensure they are up-to-date with their varicella vaccinations, receiving a second dose if only one dose has been documented, within 3-5 days of exposure if 4 weeks have passed since the first dose **(Strong Recommendation, High Grade Evidence)**
Implement daily monitoring for signs and symptoms of varicella from the 8th day after the first exposure through the 21st day after the last exposure **(Strong Recommendation, High Grade Evidence)**
For asymptomatic healthcare personnel exposed to varicella or herpes zoster, without evidence of immunity, PEP and work exclusion should be from the 8th day after the first exposure through the 21st day after the last exposure. **(Strong Recommendation, High Grade Evidence)**
For HCP with varicella (chickenpox), exclude from work until all lesions have dried and crusted, or, for those with non-vesicular lesions, until no new lesions appear within a 24-hour period **(Strong Recommendation, High Grade Evidence)**
Do not routinely exclude healthcare personnel only on the basis of their pregnancy or intent to be pregnant from the care of patients with infections that have potential to harm the fetus (e.g., Cytomegalovirus (CMV), Human Immunodeficiency Virus (HIV), viral hepatitis, herpes simplex, parvovirus, rubella, varicella); Any work restriction should be based on the specific occupational exposure risk (**Strong Recommendation, High Grade Evidence)**

Rationale

Post-exposure prophylaxis (PEP) is an important component of occupational infection prevention and control for healthcare personnel (HCP). It comprises the prompt assessment and management of healthcare personnel following a potential occupational exposure to an infectious pathogen, with the objective of preventing infection, reducing the risk of transmission, and minimizing subsequent morbidity and public health consequences.

Healthcare personnel may be exposed to infectious agents through percutaneous injuries, mucous membrane exposures, contact with non-intact skin, respiratory exposures, or other contact with infectious patients, specimens, tissues, or body fluids. The need for PEP depends on the infectious agent, the nature and severity of the exposure, the infectious status of the source, the susceptibility or immune status of the

exposed HCP, and the availability and effectiveness of an appropriate preventive intervention.

A comprehensive occupational exposure management program therefore requires rapid recognition and reporting of exposures, immediate first aid, exposure risk assessment, evaluation and testing of the source patient when appropriate, assessment of the exposed HCP, timely administration of PEP when indicated, follow-up testing and clinical monitoring, documentation, counselling, and measures to prevent secondary transmission and future occupational exposures.

Clearly defining whether an occupational exposure has occurred may require detailed assessment of the circumstances surrounding the incident, including the type of contact, body fluid involved, route of exposure, duration and severity of exposure, use of PPE, and adherence to Standard and Transmission-Based Precautions. When recommended infection prevention practices are correctly implemented, the risk of exposure may be substantially reduced. However, appropriate monitoring may still be required following exposure to highly transmissible pathogens because an unrecognized exposure or subsequent development of infection may have implications for both the affected HCP and patients.

Bloodborne Pathogens

Bloodborne pathogens of particular occupational concern include HIV, hepatitis B virus (HBV), and hepatitis C virus (HCV). Healthcare personnel may be exposed through needlestick injuries, other sharps injuries, or contact of blood or other potentially infectious materials (OPIM) with mucous membranes or non-intact skin.

The management of bloodborne pathogen exposures differs according to the pathogen. Effective PEP is available for HIV and HBV in appropriate circumstances, whereas no recommended PEP regimen is currently available for HCV. For HCV, the appropriate strategy is prompt baseline and follow-up testing to identify infection early and facilitate treatment if infection develops. CDC recommends testing HCP after potential HCV exposure rather than administering prophylactic antiviral treatment.

1. Human Immunodeficiency Virus

HIV establishes infection rapidly following exposure; therefore, occupational HIV exposure should be treated as a medical urgency. When PEP is indicated, antiretroviral therapy should be initiated as soon as possible, because earlier initiation provides a greater opportunity to prevent establishment of infection. Current CDC guidance

continues to emphasize initiation within 72 hours of exposure, with the first dose administered without unnecessary delay while relevant source or laboratory information is being obtained.

The decision to administer HIV PEP should be based on an assessment of the exposure route, the type and amount of potentially infectious fluid, the presence of non-intact skin or mucous membrane exposure, and the HIV status or likelihood of HIV infection in the source patient. PEP is not recommended when there is no substantial risk of HIV transmission.

The recommended course of HIV PEP is 28 days. The exposed HCP should receive appropriate baseline assessment, counselling, monitoring for adverse effects, and follow-up HIV testing according to the applicable occupational HIV PEP protocol.

The biological rationale for HIV PEP is that antiretroviral drugs can inhibit early viral replication and thereby reduce the probability that exposure will progress to established infection. Evidence from experimental models and accumulated occupational experience supports the importance of initiating PEP as early as possible.

A discarded needle found in the community represents a different exposure scenario from a known occupational exposure to blood from an HIV-infected source. Routine HIV PEP is not recommended for discarded-needle exposures when the circumstances do not constitute a substantial-risk exposure; management should instead be based on an individualized risk assessment.

2. Hepatitis B Virus

HBV is highly infectious and can be transmitted through occupational exposure to infected blood and certain body fluids. Unlike HCV, effective preventive interventions are available, including HepB vaccination and hepatitis B immune globulin (HBIG). Therefore, the vaccination and serological status of the exposed HCP are central to post-exposure management. CDC recommends hepatitis B vaccination for HCP with reasonably anticipated occupational exposure and recommends documenting vaccine response when indicated.

The need for HBV PEP is determined by the combination of:

- the HCP's documented HepB vaccination status;
- previous anti-HBs results, when available;
- the HBsAg status of the source patient; and
- whether the HCP has demonstrated an adequate vaccine response.

HCP with documented completion of the HepB vaccine series and a documented anti-HBs level ≥10 mIU/mL are considered protected and require no HBV PEP following exposure, regardless of the source patient's HBsAg status.

HCP with anti-HBs of 10 mIU/mL or more after receiving the primary vaccine series are considered immune. People who are immunocompetent have long-term protection and should not need further anti-HBs testing. Clinicians with anti-HBs of less than 10 mIU/mL after receiving the primary series should be revaccinated.

An increasing number of clinicians have received routine HepB vaccination during childhood. Postvaccination serological testing is not recommended after routine infant or adolescent HepB vaccination. Because vaccine-induced anti-HBs wanes over time, testing clinicians for anti-HBs years after vaccination might not distinguish vaccine non-responders from responders.

Preexposure assessment of current or past anti-HBs results upon hire or matriculation, followed by one or more additional doses of HepB vaccine for clinicians with anti-HBs of less than 10 mIU/mL and retesting anti-HBs, if necessary, helps to ensure that clinicians will be protected if they have an exposure to HBV-containing blood or body fluids.

For vaccinated HCP without previous post-vaccination serological documentation, the HCP's anti-HBs level and the source patient's HBsAg status should be assessed promptly within the first 24 hrs after exposure. When anti-HBs is <10 mIU/mL and the source is HBsAg-positive or has an unknown HBsAg status, HBIG and revaccination are indicated. When the source is HBsAg-negative, revaccination without HBIG is appropriate.

For unvaccinated or incompletely vaccinated HCP exposed to an HBsAg-positive or unknown-status source, HBIG and HepB vaccine should be administered as soon as possible, followed by completion of the vaccine series. HBIG and HepB vaccine may be administered simultaneously but at different anatomical sites (two deltoid) HCP who have completed two complete HepB vaccine series but remain anti-HBs <10 mIU/mL are considered vaccine non-responders. If exposed to an HBsAg-positive or unknown-status source, they should receive two doses of HBIG one month apart; additional HepB vaccination is not recommended in this situation. According to body weight. And under medical supervision. Because anti-HBs obtained before completion of a documented vaccine series cannot reliably establish vaccine-mediated protection, HCP who cannot provide documentation of the required vaccine doses should be managed as unvaccinated or incompletely vaccinated and should complete the vaccine series. Post-

vaccination anti-HBs testing should be performed, generally 1–2 months after completion of the vaccine series, with consideration of the effect of HBIG on interpretation of anti-HBs testing.

Following exposure to an HBsAg-positive or unknown-status source, HCP who are susceptible or have anti-HBs <10 mIU/mL should also undergo appropriate baseline and follow-up testing for HBV infection. CDC recommends baseline total anti-HBc testing and follow-up HBsAg and total anti-HBc testing approximately six months after exposure.

Vaccinated HCP, who are non-responders, should be tested for HBsAg and anti-HBc to determine infection status. Those HCPs should be considered susceptible to HBV infection if hepatitis markers are negative.

3. Hepatitis C Virus

There is currently no recommended post-exposure prophylaxis for HCV. Consequently, management focuses on early identification of infection through baseline and follow-up testing. Early detection is important because effective curative antiviral treatment is available for established HCV infection.

The risk of HCV transmission following occupational exposure is primarily associated with percutaneous exposure to infected blood. Appropriate management therefore includes prompt reporting and assessment of the exposure, testing of the source patient when appropriate, baseline testing of the exposed HCP, and follow-up testing according to the applicable HCV occupational exposure protocol.

Vaccine-Preventable and Other Occupational Infections

For vaccine-preventable infections, the primary occupational prevention strategy is to ensure that HCP have appropriate vaccination and documented evidence of immunity where applicable. Following an exposure, management depends on the HCP's immune status, the characteristics of the exposure, the infectiousness of the source, and whether an effective PEP intervention exists.

Mumps

Mumps can be transmitted through respiratory and oral secretions. Healthcare-associated transmission is uncommon but may occur, particularly because some infected individuals have mild or asymptomatic disease.

Prevention relies on ensuring that HCP have presumptive evidence of immunity and on appropriate infection prevention measures. There is no routinely recommended PEP

following mumps exposure. During outbreaks, public health authorities may recommend additional vaccination for certain HCP groups.
Asymptomatic HCP with presumptive evidence of immunity generally do not require work restriction following exposure but should undergo appropriate symptom monitoring during the relevant incubation period.

Measles

Measles is highly contagious and can be transmitted through the airborne route. Healthcare settings are particularly important environments for transmission because patients with measles may present before the diagnosis is recognized and may expose multiple HCP and patients.
Prevention therefore depends on ensuring that HCP have presumptive evidence of immunity, rapid recognition and isolation of suspected cases, appropriate Airborne Precautions, and prompt assessment of exposed HCP.
For HCP without presumptive evidence of immunity, post-exposure vaccination should be administered as soon as possible when indicated. The purpose of post-exposure vaccination is to provide protection against measles following exposure; however, vaccination does not replace appropriate monitoring and work-restriction measures when these are indicated. HCP with documented presumptive evidence of immunity generally do not require PEP or work restriction following exposure.

Rubella

Rubella is generally a mild illness in adults but is of particular public health concern because infection during pregnancy can cause severe congenital abnormalities.
Prevention in healthcare settings therefore depends on ensuring that HCP have presumptive evidence of immunity, applying appropriate infection-control precautions, and excluding infectious HCP from work when indicated.
Unlike measles, post-exposure vaccination has not been demonstrated to prevent rubella infection after exposure. Therefore, rubella vaccine is not considered effective PEP. Susceptible exposed HCP should be managed through appropriate monitoring and work restrictions according to public health guidance. Vaccination may nevertheless be indicated to establish immunity for future exposures.

Varicella-Zoster Virus (VZV)

VZV is highly transmissible in healthcare settings and may spread through direct contact and through airborne or aerosolized particles associated with vesicular lesions and respiratory secretions. Healthcare-associated transmission may occur from patients, visitors, or infected HCP.

The primary prevention strategy is to ensure that HCP have documented evidence of immunity to varicella and to apply appropriate infection prevention and control measures.

For exposed HCP without evidence of immunity, post-exposure vaccination should be administered as soon as possible. Vaccination within 3–5 days after exposure may prevent or modify disease; vaccination administered later than five days may still provide protection against subsequent exposures and should not be omitted solely because the optimal post-exposure window has passed.

For HCP who lack evidence of immunity and have a contraindication to varicella vaccination, varicella-zoster immune globulin (VariZIG) should be considered when they are at increased risk of severe varicella, including pregnant or immunocompromised HCP. It should be administered as soon as possible after exposure, within the recommended post-exposure window. Administration of VariZIG may prolong the incubation period, requiring an appropriately extended period of monitoring.

Asymptomatic HCP without evidence of immunity who have been exposed should be monitored for signs and symptoms of varicella and managed according to applicable work-restriction recommendations. HCP who develop varicella should be excluded from work until they are no longer infectious, including until lesions have dried and crusted or, in the case of non-vesicular lesions, until no new lesions have appeared for the required period.

Diphtheria

Healthcare-associated transmission of diphtheria is uncommon but may occur following close, unprotected contact with respiratory or oral secretions or drainage from infected cutaneous lesions. Higher-risk occupational activities may include airway procedures, close physical examination, and direct handling of infected lesions or their secretions without appropriate PPE.

The rationale for PEP is to prevent development of disease and interrupt further transmission among exposed HCP. Management may include assessment of vaccination

status, administration of an appropriate diphtheria-containing vaccine when indicated, antimicrobial prophylaxis, microbiological assessment, and temporary exclusion from work when clinically or epidemiologically indicated.
HCP with significant exposure should therefore be evaluated promptly according to public health and infection-control guidance.

Pertussis

Healthcare-associated transmission of Bordetella pertussis can occur between patients and HCP. Vaccination reduces the risk of disease but does not completely eliminate the possibility of infection because immunity may wane over time and vaccine effectiveness is not absolute.
Following a significant exposure, HCP should therefore undergo individual risk assessment regardless of vaccination status. When indicated, antimicrobial PEP should be provided, particularly to HCP who are likely to have contact with individuals at increased risk of severe pertussis.
The preferred antimicrobial agents for PEP include azithromycin, clarithromycin, or erythromycin, according to the applicable clinical guidance. HCP who develop suspected or confirmed pertussis should be managed to prevent transmission to patients and other staff, including appropriate exclusion from work during the infectious period.

Tetanus

Tetanus immunoglobulin (TIG) provides immediate passive protection by neutralizing circulating tetanus toxin, but it does not induce long-term immunity. Therefore, TIG is indicated for individuals with tetanus-prone wounds who are not adequately vaccinated or whose vaccination status is unknown, because they may lack sufficient protective antitoxin antibodies. TIG is also recommended for immunocompromised individuals, even when fully vaccinated, because their immune response to previous vaccination may be inadequate to provide reliable protection. When both TIG and tetanus-containing vaccine are indicated, they should be administered at separate anatomical sites using separate syringes.

Meningococcal Disease

Healthcare-associated transmission of Neisseria meningitidis is uncommon but may occur following direct exposure to respiratory secretions, particularly during airway

management or other procedures that generate contact with oral or respiratory secretions.

Prevention includes Standard Precautions, Droplet Precautions for patients with suspected or confirmed meningococcal disease, rapid diagnosis and treatment, and appropriate chemoprophylaxis for HCP who have had a significant exposure.

Chemoprophylaxis is intended to eradicate nasopharyngeal carriage and prevent subsequent invasive disease. It should be administered as soon as possible after a significant exposure, with commonly recommended options including rifampin, ciprofloxacin, or ceftriaxone according to applicable antimicrobial-resistance considerations and public health guidance.

HCP who develop suspected or confirmed invasive meningococcal disease should be excluded from work until they have received appropriate antimicrobial therapy for at least 24 hours.

Rabies

Rabies is a nearly universally fatal disease once clinical symptoms develop; consequently, prevention following a genuine exposure is critical. Occupational transmission to HCP during routine patient care has not been confirmed, and routine healthcare contact with a patient with rabies is not itself an indication for PEP.

PEP is considered when an HCP has had a potential exposure capable of transmitting rabies, such as a bite, scratch, or mucous membrane exposure to infectious material. Immediate and thorough wound cleansing is an essential first step because it reduces the amount of virus at the exposure site.

The decision to administer PEP should be based on the type of exposure, the animal/source characteristics, the circumstances of the exposure, and applicable public health guidance.

According to Egyptian Ministry of Health and Population recommendations (2025), for previously unvaccinated individuals, rabies PEP consists of rabies immunoglobulin (RIG) on Day 0 and rabies vaccine on Days 0, 3, 7, and 14. For previously vaccinated individuals, two vaccine doses are administered on Days 0 and 3, and RIG is not indicated.

8. Indicators for Monitoring

To ensure the appropriate management of post exposure prophylaxis in healthcare facilities specific indicators should be monitored regularly. These are some indicators which can provide measurable data to assess compliance, identify areas for improvement, and guide interventions. Here are some key indicators that can be included in hospital guidelines for management of post exposure prophylaxis.
This document provides detailed Key Performance Indicators (KPIs) for PEP in healthcare settings, including definitions, calculation formulas, and performance targets. KPIs are categorized into Structure, Process, and Outcome indicators.

1. **Immunity Records for Healthcare Personnel**
- Definition: Tracks the percentage of healthcare personnel with documented immunity to vaccine-preventable diseases.
- Formula: (Number of HCP with immunity records / Total number of HCP) × 100

2. **24/7 PEP Service Accessibility**
- Definition: Evaluates whether PEP services are accessible at all times, including weekends and holidays.
- Formula: Availability verified by operational hours and emergency access logs.

3. **Time from Exposure to PEP Initiation (HIV)**
- Definition: Measures the average time taken to start PEP after an exposure event.
- Formula: Average (Time of PEP initiation - Time of exposure) in hours

4. **Post-Exposure Reporting Rate**
- Definition: Measures how many exposures are reported within the critical first hour.
- Formula: (Number of exposures reported within 1 hour / Total number of exposures) × 100

5. **Completion Rate of PEP Regimens**
- Definition: Tracks how many healthcare personnel complete the full PEP regimen.
- Formula: (Number of HCP completing PEP / Number of HCP starting PEP) × 100

6. **Counselling and Follow-Up Rate**
- Definition: Assesses the percentage of exposed HCP receiving appropriate follow-up care.
- Formula: (Number of HCP receiving follow-up / Number of exposed HCP) × 100

7. **Incidence of Occupational HIV/HBV/HCV Seroconversion**
- Definition: Measures how many healthcare personnel seroconvert after occupational exposure.
- Formula: (Number of confirmed seroconversions / Number of exposures) × 1,000

8. **Healthcare Personnel Satisfaction with PEP Services**
- Definition: Measures satisfaction levels with PEP services through structured surveys.
- Formula: (Number of satisfied responses / Total responses) × 100

9. **Reduction in Needle Stick Injuries (NSIs)**
- Definition: Tracks the year-over-year change in needle stick injuries among HCP.
- Formula: [(NSIs last year - NSIs this year) / NSIs last year] × 100

10. Plan to Update this National Clinical Guideline

This guideline will be reviewed and updated when new evidence emerges that is likely to influence the recommendations.

Annex

Table (1): This table showcases postexposure testing, postexposure prophylaxis, and postvaccination serological testing guidance for health care providers and HCP, depending on their vaccination status recruited from CDC, 2024

HCP status	Post-exposure testing		Post-exposure prophylaxis		Post-vaccination serologic testing
	Source patient	HCP testing	HBIG	Vaccination	
Documented responder after complete series	No action needed				
Documented non-responder after two complete series	Positive/unknown	—	HBIG x2 separated by 1 month	—	n/a
	Negative	No action needed			
Response unknown after complete series	Positive/unknown	<10 mIU/mL	HBIG x1	Initiate revaccination	Yes
	Negative	<10 mIU/mL	—	Initiate revaccination	Yes
	Any result	≥10 mIU/mL	—	—	—
Unvaccinated/incompletely vaccinated or vaccine refusers	Positive/unknown	—	HBIG x1	Complete vaccination	Yes
	Negative	—	None	Complete vaccination	Yes

References

1. Centers for Disease Control and Prevention. (2025). *Clinical guidance for wound management to prevent tetanus.*
2. Centers for Disease Control and Prevention. (2024). *Infection control in healthcare personnel: Epidemiology and control of selected infections transmitted among healthcare personnel and patients.*
3. Centers for Disease Control and Prevention. (2024, May 16). *Responding to HBV exposures in health care settings.*
4. Health Protection Surveillance Centre. (2024). *Guidelines for the emergency management of injuries (EMI) and post-exposure prophylaxis (PEP).*
5. Australian Government Department of Health. (2023). *Australian Immunisation Handbook.*
6. Centers for Disease Control and Prevention. (2022). *Clinical guidelines for management of healthcare personnel exposed to pertussis.*
7. Centers for Disease Control and Prevention. (2022). *Updated U.S. Public Health Service guidelines for the management of occupational exposures to HIV and recommendations for postexposure prophylaxis. MMWR Recommendations and Reports, 71*(RR-1), 1–28.
8. Occupational Safety and Health Administration. (2021). *Bloodborne pathogens standard, 29 CFR 1910.1030.*
9. World Health Organization. (2021). *Guidelines on post-exposure prophylaxis for HIV and the use of co-trimoxazole prophylaxis for HIV-related infections among adults, adolescents and children: Recommendations for a public health approach.*
10. Kuhar, D. T., Henderson, D. K., Struble, K. A., Heneine, W., Thomas, V., Cheever, L. W., et al. (2013). Updated U.S. Public Health Service guidelines for the management of occupational exposures to HIV and recommendations for postexposure prophylaxis. *Infection Control & Hospital Epidemiology, 34*(9), 875–892.