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Mass General Brigham

# Managing Bloodborne Pathogen Exposures at Academic Medical Centers (AMCs)

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# Learning Objectives and Outcomes

**Upon completing this session, learners will be able to:**

1. **Define** blood and body fluid exposure and identify potentially infectious body fluids;
2. **Ensure** completion of required baseline laboratory testing prior to initiation of HIV post-exposure prophylaxis (PEP), followed by adherence to guideline-based post-exposure testing protocols;
3. **Identify** current HIV PEP medications and surveillance schedules;
4. **Understand** treatment recommendations and limitations for HBV and HCV exposures;
5. **Be familiar** with current recommendations for BBP exposure and testing guidelines;
6. **Manage** complex cases; and
7. **Provide** education to injured workers and address fears and anxiety.

# Overview and Why Bloodborne Pathogen Management Matters

- **Prevalence of Exposure Injuries:** Bloodborne pathogen (BBP) exposures are among the most frequent occupational injuries in healthcare, occurring over 385,000 times annually in U.S. hospitals.
- **Common Bloodborne Pathogens and Health Risks of Exposure:** BBP exposures are frequent occupational hazards with potentially serious health and emotional impacts.
- **Complexity of Academic Medical Centers (AMCs):** AMCs combine healthcare, research, and training, increasing the frequency and variety of exposure risks for staff.
- **Unique Risk Factors:** High procedural volume, patient acuity, and trainee inexperience, Occupational Health Services (OHS) not always onsite, high tempo hospital operations (includes off-hours), high risk populations, exposures in research areas.
- **Consequences of Poor Management:** Improper management may lead to higher infection risk and undue anxiety among employees, highlighting the need for standardized protocols and quick action.

# Nursing Practice Gaps and Opportunities for Improvement

- **Outdated Guidance:** Previous comprehensive guidelines like the 2001 MMWR recommendations are outdated due to advances in diagnostics and prophylaxis.
- **Updated HIV PEP Recommendations:** 2025 U.S. Public Health Service Guidelines for the management of HIV and recommendations for post-exposure prophylaxis in healthcare settings.
- **Nursing Practice Gaps:** Nurses face inconsistent guideline use, variable experience, and increased anxiety among injured workers, impacting clinical decisions.
- **Opportunities for Improvement:** Enhanced education, standardized training, and integration of high-reliability practices can bridge gaps.

# Exposure Types

## Common (and Uncommon) Exposure Routes

- Needlestick injuries
- Other sharps punctures
- Contact with patient blood or other body fluids (e.g., splashes to mucous membrane or non-intact skin)
- Bites (uncommon): The risk from a human bite has also not been quantified. However, transmission of HBV, HCV, and HIV by human bites has been reported (none in healthcare). Importantly, human bites that penetrate the skin should be considered as potential two-way exposure (i.e., from patient-to-HCP and HCP-to-patient).

## Infectious Fluids

- Blood (or visibly bloody fluid), semen, vaginal secretions, human milk, cerebrospinal fluid (CSF), synovial, pleural, peritoneal, pericardial and amniotic fluids.
- Tissue (unfixed)

## Not Considered Exposures

- Contact of intact skin with blood or body fluids
- Skin was not breached by a sharp
- Contact with saliva (non-dental), urine, sputum, vomit, or feces that was not visibly contaminated with blood
- Sharp that was not contaminated before the injury

# Relative Risk of Fluids in Occupational Exposure to HIV

Table 2.
**Relative Risk of Fluids in Occupational Exposure to HIV**

| Category of Infectivity | Fluid |
|---|---|
| **Infectious Fluids** | Blood |
| | Visible bloody body fluids |
| **Potentially Infectious Body Fluids** | Semen and vaginal secretions |
| | Cerebrospinal fluid |
| | Synovial fluid |
| | Pleural fluid |
| | Peritoneal fluid |
| | Pericardial fluid |
| | Amniotic fluid |
| **Not considered infectious** | Nasal secretions |
| | Saliva |
| | Sputum |
| | Vomitus |
| | Feces |
| | Urine |
| | Sweat and tears |

*Note: although semen and vaginal secretions are known to be infectious for HIV in sexual exposures, they have not been implicated in transmissions in the occupational setting.

# Transmission Risks

## ➢ HBV (highly transmissible and long-lasting)

Number of infections among HCP declined by ~ 98% from an estimated 17K infections in 1983 to 263 acute infections in 2010. This decline was due to decreased exposure from improved work practice controls and HBV immunization.

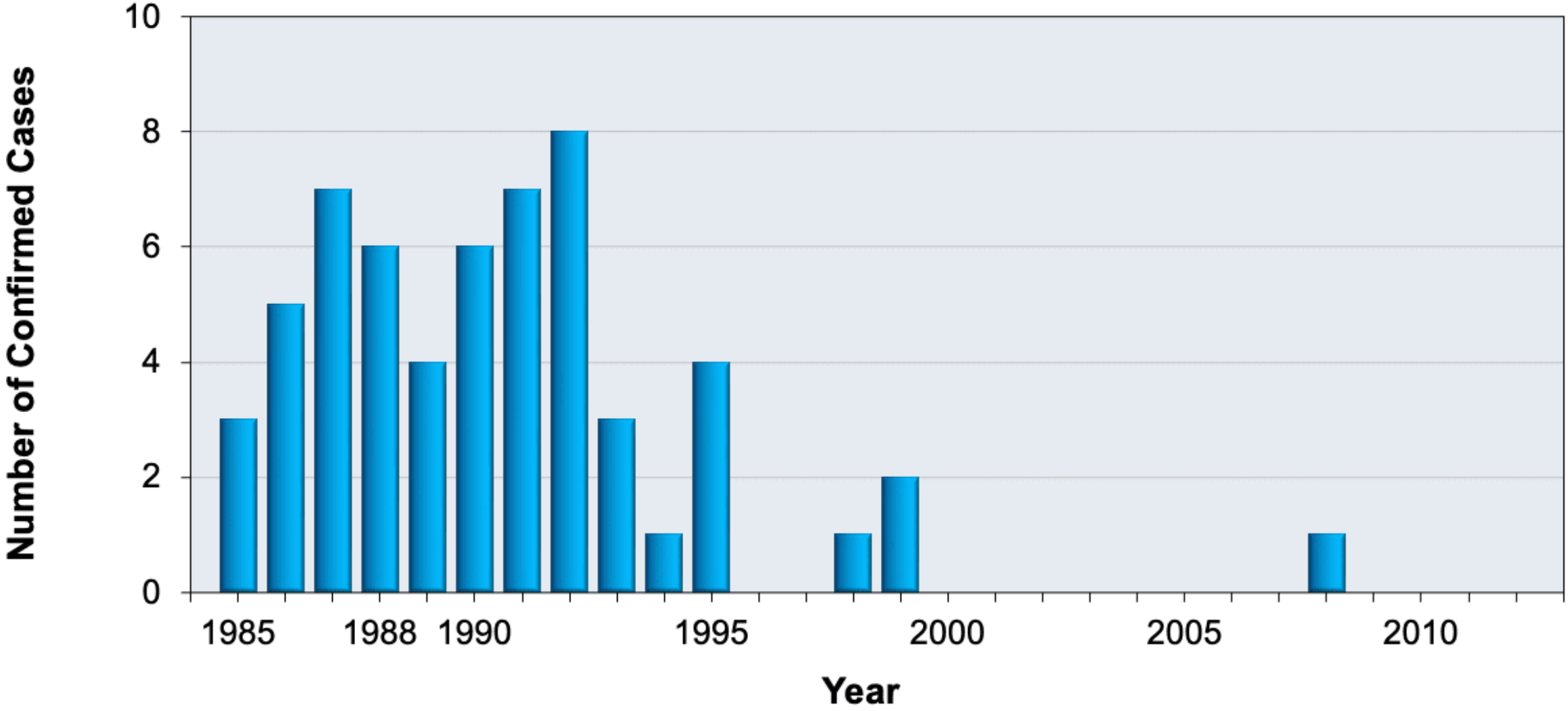
## ➢ HCV (transmits less frequently)

The estimated risk of infection from percutaneous exposure to anti-HCV–positive blood is ~ 0.2% (2 of 885).

## ➢ HIV (occupational transmission is rare but critical)

In the U.S., greater than 100 confirmed and possible cases of occupationally acquired HIV infection were reported to the CDC between 1985 and 2013. Since 1999, only one confirmed case has been reported.

# HIV Transmission in Healthcare



# Risk of Exposure

## 2022 Massachusetts Sharps Injury Data

### Data based on:

Hospital size

Service type

Teaching status

| | Hospitals | | Sharps Injuries | | Rate per 100 licensed beds | 95% CI |
|---|---|---|---|---|---|---|
| **Hospital size** | **N** | **%** | N | % | | |
| Small (< 100 licensed beds) | 26 | 29.2 | 167 | 5.8 | 12.3 | 10.5-14.2 |
| Medium (101-300 licensed beds) | 45 | 50.6 | 815 | 28.3 | 9.8 | 9.1-10.5 |
| Large (>300 licensed beds) | 18 | 20.2 | 1,896 | 65.9 | 19.6 | 18.7-20.5 |
| **Service Type** | | | | | | |
| Acute care | 71 | 79.8 | 2,826 | 98.2 | 19.2 | 18.5-19.9 |
| Non-acute care* | 18 | 20.2 | 52 | 1.8 | 1.9 | 1.4-2.4 |
| **Teaching Status** | | | | | | |
| Teaching | 17 | 19.1 | 1,814 | 64.2 | 27.9 | 16.6-29.2 |
| Non-teaching | 72 | 80.9 | 1,064 | 37. | 9.8 | 8.8-9.9 |
| **Total** | **89** | **100** | **2,878** | **100** | **16.4** | **15.8-17.0** |

*Non-acute care hospitals include chronic care and rehabilitation facilities.

**Table 1b. Number and rate of sharps injuries among hospital workers by hospital characteristics, Massachusetts, 2022**

| | Hospitals | | Sharps Injuries | | Rate per 100 licensed beds | 95% CI |
|---|---|---|---|---|---|---|
| **Hospital size** | **N** | **%** | N | % | | |
| Small (< 100 licensed beds) | 27 | 30.3 | 172 | 6.3 | 12.1 | 10.3-13.9 |
| Medium (101-300 licensed beds) | 44 | 49.4 | 834 | 30.4 | 9.8 | 9.1-10.5 |
| Large (>300 licensed beds) | 18 | 20.2 | 1,737 | 63.3 | 18.0 | 17.1-18.8 |
| **Service Type** | | | | | | |
| Acute care | 71 | 79.8 | 2,702 | 98.5 | 18.3 | 17.6-19.0 |
| Non-acute care* | 18 | 20.2 | 41 | 1.5 | 1.5 | 1.0-2.0 |
| **Teaching Status** | | | | | | |
| Teaching | 18 | 20.2 | 1,724 | 62.9 | 26.1 | 24.9-27.4 |
| Non-teaching | 71 | 79.8 | 1,019 | 37.2 | 9.4 | 8.8-9.9 |
| **Total** | **89** | **100** | **2,743** | **100** | **15.7** | **15.1-16.3** |

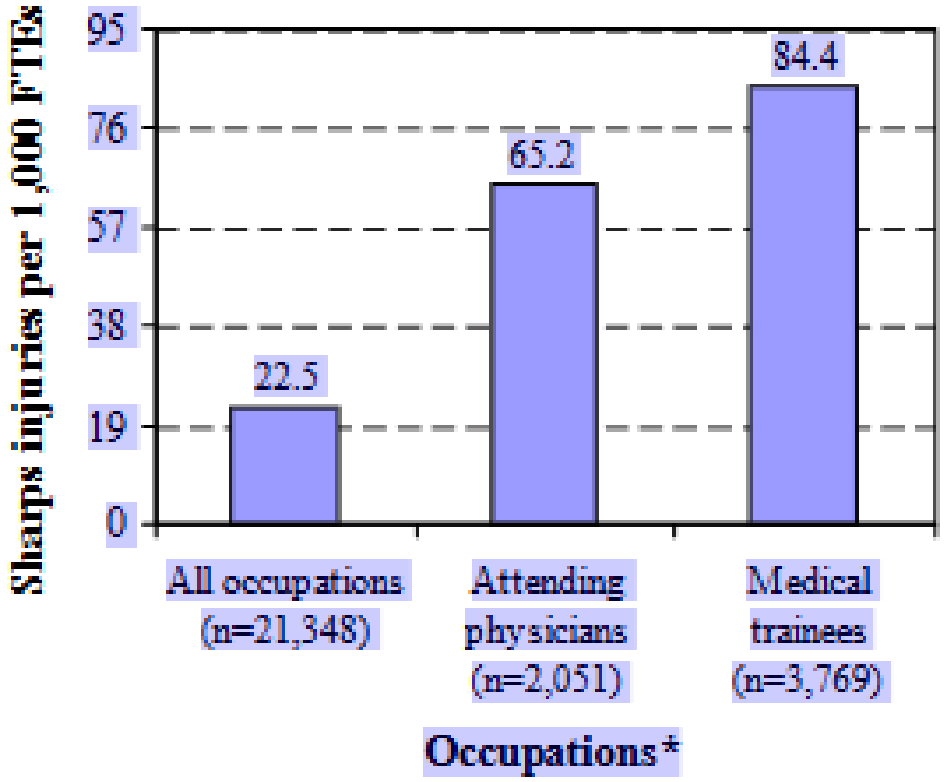
*Non-acute care hospitals include chronic care and rehabilitation facilities.

# Experience vs. Reporting Bias

**FIGURE 10. SHARPS INJURY RATES BY OCCUPATION**

Overall, medical trainees have the highest sharps injury rate (84 injuries per 1,000 trainee FTEs) in MA acute care hospitals, compared to other occupations (data not shown), and this is consistent with studies previously published.[22-23] Attending physicians have the second highest sharps injury rate (65 injuries per 1,000 attending FTEs).

*Rate analysis was restricted to sharps injuries among hospital employees in 77 acute care hospitals for which hospital employment data was available.






**Underreporting of sharps injuries is common in healthcare.**

**Higher risk vs. higher exposure vs. higher reporting?**

**In a 2007 study conducted at five academic medical centers,** fatigue associated with long work hours, and sleep deprivation was associated with a threefold increase in the risk of needlestick injuries.

A survey performed among 699 surgeons-in-training at 17 medical centers found that the mean number of needlestick injuries by the fifth (final) year of residency was 7.7 and that 99 percent of residents had at least one needlestick injury.

Approximately ½ of the injuries involved a high-risk patient, and more than half had not been reported. The most common reason was lack of time.

# Hepatitis B Virus (HBV)

## Environmental Survival

- HBV is highly infectious and has been demonstrated to survive >7 days on environmental surfaces.
- Seroprevalence: HBV ~0.17% to 0.70% (general population)

## Transmission Risks

- Depends on HBsAg and HBeAg status; needlestick exposures to highly infectious sources can cause hepatitis in up to 31%.
- Depends on route of exposure, HCP immune status, and status of the source patient (i.e. HBsAg plus HBeAg positive).
- Per CDC: Studies of susceptible HCP who sustained injuries from needles contaminated with blood containing HBV, the risk for developing clinical hepatitis if the blood was both HBsAg-positive and **HBeAg-positive** was 22%–31%. By comparison, the risk with HBsAg-positive, **HBeAg-negative** blood was 1%–6%.
- Risk via mucous membrane or non-intact skin exposure has not been quantified.

# Hepatitis B Virus (HBV)

## Prophylaxis/Vaccination

- Prevention remains the most effective strategy against HBV.
  - Heplislav (2 dose series): $95/dose
  - Energix (3-dose series): $40/dose

## Post-Exposure Management

- CDC infection control table guides exposure management.
- Administer HBIG: IM: 0.06 mL/kg and HBV vaccine as soon as possible after exposure (w/in 24 hours).
  - **HBIG within seven days**.
- PEP: Hepatitis B immune globulin (HBIG): $680/vial

| 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 |

# Post-Exposure Hepatitis B Lab Testing for Non-Immune HCP

- **Baseline testing for HBV infection as soon as possible after the exposure** and follow-up testing approximately 6 months later.
  - HBsAb if fully vaccinated and no post-vaccine titer
  - HBsAg and anti-HBc
- **Six-month follow-up:**
  - HBsAg and anti-HBc
- **Test for HBsAb after completion of second vaccine series**
  - Must wait at least 6 months for HBsAb to test for immunity if HBIG was given
- **HCP do not need to take special precautions to prevent secondary transmission.**
  - OK to breastfeed/become pregnant
  - Should avoid blood, plasma, organ, tissue, or semen donation

# Case Study Potential Hepatitis B Exposure

- HCP with 2 documented Hep B vaccines 2012
- 2022 HBsAB: > 500
- HBsAB > 200 date of injury (given dose #3)
- Source unknown (needle in sharps container)
- HBIG?

# Hepatitis C Virus (HCV)

## Environmental Survival

- Data on environmental survival has varied with papers reporting survival of 16 hours, 5 days, and up to 6 weeks.
- Seroprevalence: HCV ~0.60%

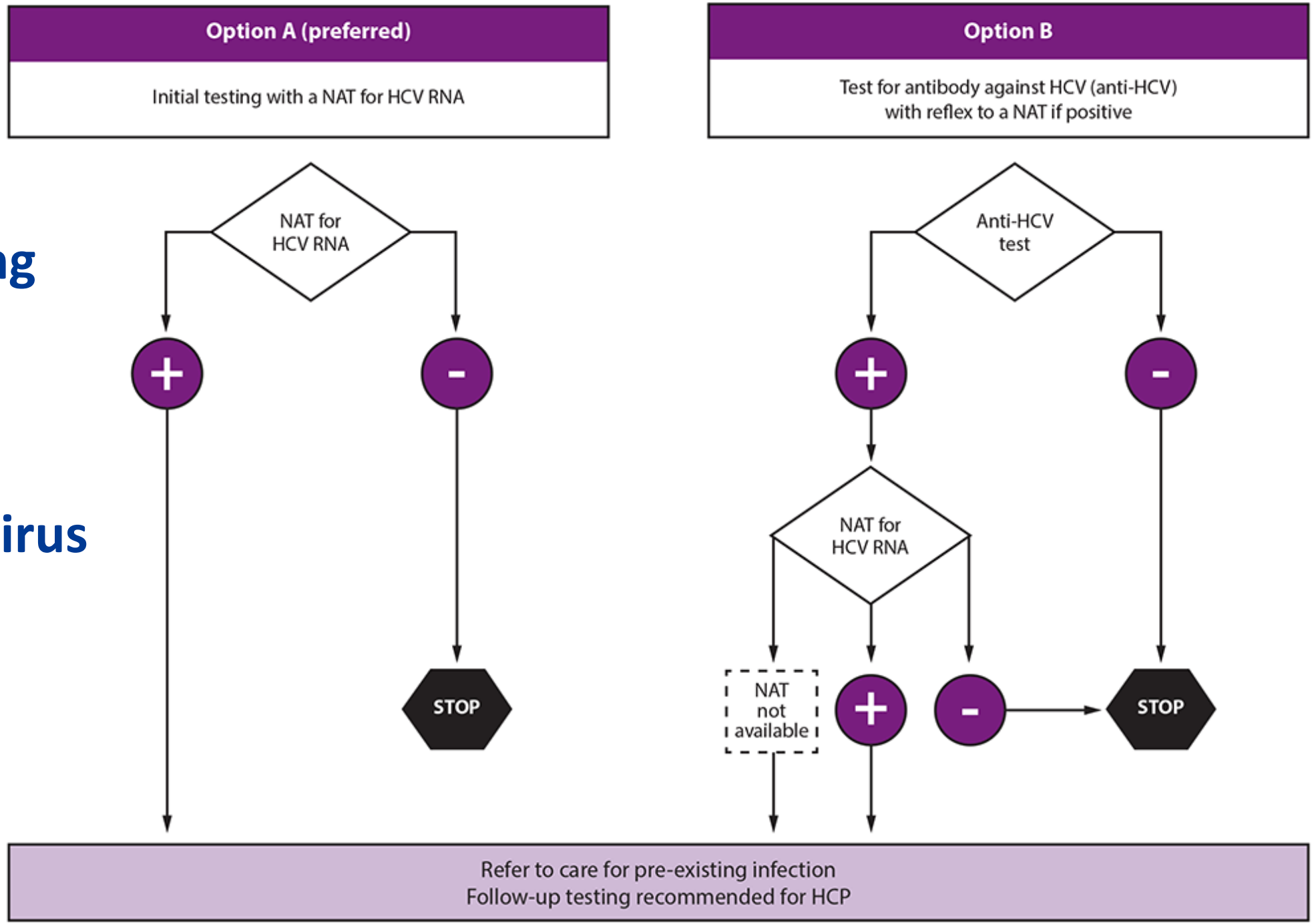
## Transmission Risks

- Risk from percutaneous exposure is estimated at 0.2% (95%CI, 0%-0.52%).
- Risk via mucous membrane or non-intact skin exposure has not been quantified.

## Post-Exposure Management

- No PEP exists; management involves testing, counseling, and monitoring with HCV RNA tests.

# Source Testing After HCP Potentially Exposed to Hepatitis C Virus (2020)



# HCP Testing Post-Exposure

## Baseline Testing

- Anti-HCV with testing for HCV RNA if positive
  - If positive: Refer for care
  - If HCV antibody positive/RNA negative: Likely cleared infection

## Post-Exposure Testing

Source patient positive (or unknown)

- 3-6 weeks: HCV RNA
- 4-6 months: HCV Antibody (or RNA if HCV antibody positive at baseline)

# Human Immunodeficiency Virus (HIV)

**Estimated per-act risk for acquisition of HIV, by exposure route**

| Exposure route | | Risk per 10,000 exposures to an infected source (risk) |
|---|---|---|
| Blood-borne exposure | Blood transfusion | 9000 (9/10) |
| | Needle-sharing injection drug use | 67 (1/150) |
| | Percutaneous needle stick | 23 (1/435) |
| | Mucous membrane exposure to blood (eg, splash to eye) | 10 (1/1000) |
| Sexual exposure | Receptive anal intercourse | 138 (1/72) |
| | Insertive anal intercourse | 11 (1/900) |
| | Receptive penile-vaginal intercourse | 8 (1/1250) |
| | Insertive penile-vaginal intercourse | 4 (1/2500) |
| | Receptive or insertive penile-oral intercourse | 0-4 |
| Other | Biting, spitting, throwing body fluids (including semen and saliva), sharing sex toys | Negligible |

There are scant empiric data on per contact risk of exposure. This table lists the estimated risk by exposure type in the absence of antiretroviral treatment of the HIV-infected source and in the absence of amplifying factors. Most of these estimates are derived through modeling studies of different cohorts. Clinicians need to be aware that estimates of sexual risk are often based on studies of monogamous couples among whom amplifying factors have been treated and repeated exposure may offer as yet unexplained protection from infection. Using a single value for assessing risk of HIV transmission based on route of sexual exposure fails to reflect the variation associated with important cofactors. A variety of amplifying factors and conditions have been identified, and these factors can be expected to increase transmission probability.


*Data from:*

1. *Donegan E, Stuart M, Niland JC, et al. Infection with human immunodeficiency virus type 1 (HIV-1) among recipients of antibody-positive blood donations. Ann Intern Med 1990; 113:733-9.*
2. *Baggaley RF, Boily MC, White RG, Alary M. Risk of HIV-1 transmission for parenteral exposure and blood transfusion: A systematic review and meta-analysis. AIDS 2006; 20:805.*
3. *Kaplan EH, Heimer R. HIV incidence among New Haven needle exchange participants: updated estimates from syringe tracking and testing data. J Acquir Immune Defic Syndr 1995; 10:175-6.*
4. *Patel P, Borkowf CB, Brooks JT, et al. Estimating per-act HIV transmission risk: A systematic review. AIDS 2014; 28:1509-19.*
5. *Cohen MS. Amplified transmission of HIV-1: Missing link in the HIV pandemic. Trans Am Clin Climatol Assoc 2006; 117: 213–225.*
6. *Centers for Disease Control and Prevention, US Department of Health and Human Services. Updated Guidelines for Antiretroviral Postexposure Prophylaxis After Sexual, Injection Drug Use, or Other Nonoccupational Exposure to HIV—United States, 2016.*


## Environmental Survival

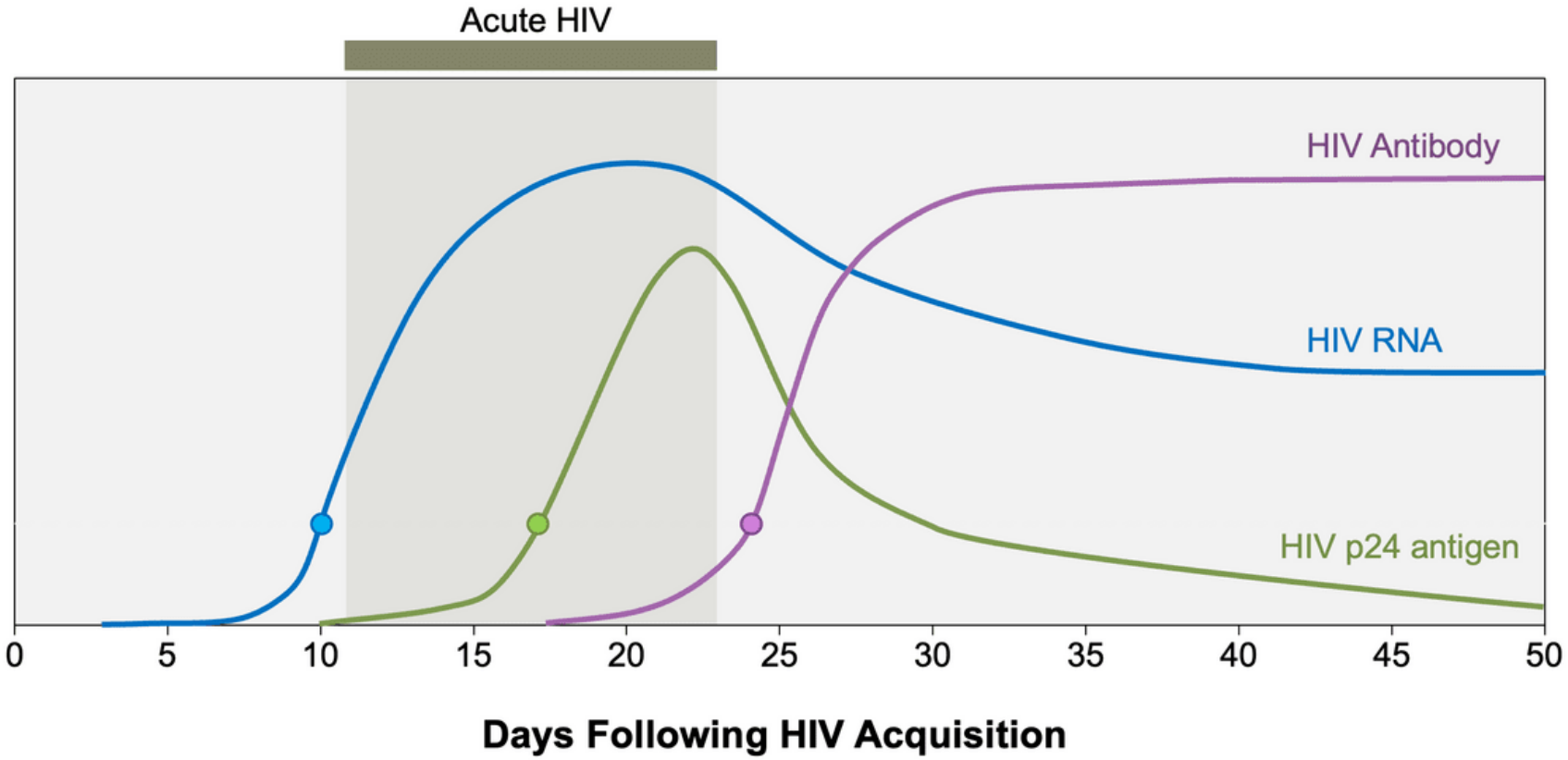
- Environmental survival has been reported as ~ 28 hours with a maximum of several days.
- Seroprevalence: HIV ~0.35%

## Transmission Risks

- Risk following percutaneous exposure = 0.2 to 0.3%
- Risk via mucosal route = 0.09%
- Risk via exposure of non-intact skin is likely <0.1% but has not been completely quantified.

# HIV Seroconversion Window Period

- **Estimated time for first detection of HIV after HIV acquisition**
  - 10 days with an HIV-1 RNA test
  - 17 days with an HIV antigen-antibody test
  - 24 days with an HIV antibody test alone




- **There have been no documented occupational transmissions of HIV related to an exposure involving a source patient in the window period.**

# Occupational Exposure Risk Assessment

## 1. HIV Status of Source Patient

- Known
  - Last RNA level
  - Current medication regimen
  - Any history of drug resistance

## 2. Type of Body Fluid

## 3. Nature of Exposure

- Percutaneous
- Mucous membrane
- Nonintact skin

# Unique Considerations

## Pregnant or Breastfeeding

- PEP regimens are considered safe
- Pump and Dump?

## HCP taking PrEP:

- How recent did they start
- Adherence (? Missed doses)
- Daily or intermittent regimen
- Source patient resistance

## HCP with Renal or Hepatic Insufficiency

- Dosing adjustments

## Source HIV Positive with Undetectable Viral Level

- Sexual transmission: undetectable = untransmissible
- Occupational exposures = unknown (likely very low)
  - Obtain expert consultation
  - Shared decision making

# Human Immunodeficiency Virus (HIV)

- Decontaminate wound or flush mucous membranes
- **Post-Exposure Prophylaxis (PEP)**
- Initiate PEP promptly without waiting for test results (72-hour window, however, ASAP is recommended)
  - PEP effectiveness decreased after 24 hours in animal studies

- **PEP Recommendations:**
  - Safe and effective (includes pregnancy)
  - Take first dose ASAP (do not wait on source patient testing)
  - Baseline labs: HIV AB, ALT/AST, serum Cr
  - No need for follow up labs unless baseline abnormal or HCP is symptomatic
    - Previously repeated at 2 weeks
- **Preferred PEP Regimen is Integrase Strand Transfer Inhibitors PLUS Two Nucleoside Reverse Transcriptase Inhibitors**
  - Bictegravir 50mg/Emtricitabine 200mg/Tenofovir Alafenam 25mg (Biktarvy): $135/tab
  - Emtricitabine – tenofovir 200-300mg (Truvada) + Dolutegravir 50mg: $60 combined

# Human Immunodeficiency Virus (HIV)

## Post-exposure Prophylaxis (PEP) - continued

- **Counseling should be provided to exposed HCP including:**
  - Importance of adherence to PEP
    - Re-evaluate @ 72 hours for PEP tolerability
  - Use of precautions (i.e., use of barrier contraception, avoidance of blood or tissue donations)
  - Drugs that should not be taken with PEP or require dose or administration adjustments, side effects of prescribed PEP, Example: Metformin
  - Importance of clinical evaluation if any acute symptoms (i.e., side effects PEP, symptoms of acute HIV)

- **Post-exposure Lab Testing**
  - If PEP was initiated more than 24 hours after the exposure or if the HCP missed any doses, testing with antigen-antibody PLUS HIV RNA should be performed **4 weeks** post-exposure.
  - For HCP on PEP, updated guidelines from the United States Public Health Service support follow-up testing at **12 weeks** post-exposure with both an antigen-antibody combination test PLUS HIV RNA assay.

## Management of Occupational Exposures to HIV and Recommendations for Post-exposure Prophylaxis (PEP) for Healthcare Personnel

1. **Initiate PEP** as soon as possible, up to 72 hours following the occupational exposure to HIV
2. **When considering initiation of PEP** after 72 hours following occupational exposures thought to represent a high risk of transmission, consult a provider with expertise in HIV treatment
3. **Prescribe PEP regimens** for a duration of 28 days if source positive (if source negative and PEP started empirically, discontinue to source HIV negative)
4. **Do not delay administration of PEP** while waiting for information regarding the source patient's HIV status
5. **Discontinue PEP and HIV follow-up testing** if the source patient is determined to be HIV negative
6. **Re-evaluate exposed HCP** within 72 hours after occupational exposure to assess for further counseling needs and PEP tolerability.
7. **Consult a provider with expertise in HIV treatment** for HCP unable to take the initial PEP regimen due to intolerance or toxicity
8. **Refer HCP** determined to have HIV infection at baseline or identified through post-exposure testing to a provider with expertise in HIV treatment
9. **Perform baseline laboratory tests** of exposed HCP as soon as possible after exposure, including: (a) a. A rapid or lab-based fourth-generation HIV Ag/Ab combination immunoassay, and (b) b. Serum creatinine, aspartate transaminase (AST) and alanine transaminase (ALT).
10. **Perform follow-up testing** of serum creatinine, AST, and ALT only when baseline tests are abnormal or there are clinical indications (e.g., signs or symptoms of kidney or liver injury).
11. **Perform laboratory-based HIV tests** (e.g., HIV RNA test) for any exposed HCP who has an illness compatible with an acute retroviral syndrome, regardless of the interval since exposure

# Case Studies

## Case Study 1:

**Employee exposure to source with unknown HIV status**

- Employee on HIV PrEP
- Standard daily regimen
- No missed doses
- Taking for > 3 months

## Case Study 2:

**Source patient: 6-month-old child**

- Cannot perform HIV 4$^{th}$ generation (need to order HIV viral load)
- Is mother available for testing?

## Case Study 3:

**Employee exposure to deceased patient**

- Pre-mortem blood available
- Only postmortem blood available

# Case Study 4:

## Lentivirus use in Research

- Lentiviral vectors (LVVs) and Retroviral vectors (RVVs) increasingly utilized as mechanisms to transfer genetic material (transgenes) into cells.
- LVVs are in the Lentivirus genus, primarily derived from human immunodeficiency virus 1 (HIV-1; a complex retrovirus)
- Most LVVs in use today have been attenuated and are designed to prevent reversion to a wild-type virus or a replication-competent variant virus.

## Clinical use and false positive HIV:

- LVVs widely used in CAR T-cell therapy to stably introduce chimeric antigen receptor (CAR) genes into patient T-cells for treating cancers, particularly B-cell malignancies. Derived from HIV, these engineered, replication-incompetent vectors efficiently transduce dividing and non-dividing cells, ensuring long-term CAR expression

# After-Hours Management Programs

## After-Hours Occupational Health Services (OHS) Model

- A specialized model supports healthcare workers exposed outside business hours to reduce emergency visits and improve care access.

## Streamlined Workflow and Testing

- OHS clinicians assess risk, counsel employees, and obtain source patient testing.

## Expedited PEP Access and Clinical Support

- If PEP elected, expedited access through PACU (open 24 hours) to have blood collected.
- OHS clinician calls inpatient pharmacy to dispense PEP (enough until next OHS business day).
- National Clinicians' Post-Exposure Prophylaxis (24-hour) Hotline, 1-888-448-4911

## Privacy and Quality Safeguards

- Operational safeguards, including paper requisitions, protect patient privacy and maintain high-quality exposure response standards.

# SHEA Guidance and Recommendations for Infected HCP

**SHEA Guidance for Healthcare Workers with HIV, Hepatitis (2020)** continues to recommend oversight as an appropriate component of the management of HCP living with bloodborne pathogens who perform exposure-prone procedures.

**HBV:** Personnel with a viral load <1,000 IUs can perform these procedures with expert review panel guidance, strict monitoring, and proper technique.

**HIV:** Generally, infected providers with a viral load <200 copies/ml are not restricted from performing these procedures, though they must double-glove.

**Category III Procedures:** High-risk, exposure-prone surgical and invasive acts where a healthcare worker's blood is likely to contact a patient's open cavity, posing a risk of HBV, HCV, or HIV transmission. These include deep, manual, or blind procedures lasting over 3 hours, such as major cardiothoracic, neuro, and open trauma surgeries.

- Only 5 instances of healthcare personnel (HCP)-to-patient transmission since 2010
- HBV (n = 2) Ortho and Gyn surgeons. [both unaware of status (high viral loads)]
- HCV (n = 3): Hemodialysis/postpartum care/home care (all in Europe)
- HIV (n = 0)

# Key References


1. **HIV:** Kofman AD, Struble KA, Heneine W, Gayle B, de Perio MA, Okasako-Schmucker DL, So CN, Anderson LE, Stone EC, Henderson DK, Kuhar DT. 2025 US Public Health Service Guidelines for the Management of Occupational Exposures to Human Immunodeficiency Virus and Recommendations for Post-exposure Prophylaxis in Healthcare Settings. Infect Control Hosp Epidemiol. 2025 Sep;46(9):863-873. doi: 10.1017/ice.2025.10254. Epub 2025 Sep 15. PMID: 41569270; PMCID: PMC12616222.

2. **HBV:** CDC Guidance for Evaluating Health-Care Personnel for Hepatitis B Virus Protection and for Administering Postexposure Management. Recommendations and Reports. December 20, 2013 / 62(RR10);1-19. https://www.cdc.gov/mmwr/preview/mmwrhtml/rr6210a1.htm

3. **HBV:** Schillie S, Vellozzi C, Reingold A, et al. Prevention of Hepatitis B Virus Infection in the United States: Recommendations of the Advisory Committee on Immunization Practices. MMWR Recomm Rep 2018;67(No. RR-1):1–31. DOI: http://dx.doi.org/10.15585/mmwr.rr6701a1

4. **HCV:** Moorman AC, de Perio MA, Goldschmidt R, et al. Testing and Clinical Management of Health Care Personnel Potentially Exposed to Hepatitis C Virus — CDC Guidance, United States, 2020. MMWR Recomm Rep 2020;69(No. RR-6):1–8. DOI: http://dx.doi.org/10.15585/mmwr.rr6906a1.

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# Sources by Slide: Tables, Figures, Graphs

- **Slide 8:** Kuhar DT, Henderson DK, Struble KA, et al. Updated US Public Health Service Guidelines for the Management of Occupational Exposures to Human Immunodeficiency Virus and Recommendations for Postexposure Prophylaxis. Infect Control Hosp Epidemiol. 2013;34:875-92.
- **Slide 10:** Figure 2. Confirmed Cases of Occupationally Acquired HIV in the United States, 1985-2013

  Joyce MP, Kuhar D, Brooks JT. Notes from the field: occupationally acquired HIV infection among health care workers - United States, 1985-2013. MMWR Morb Mortal Wkly Rep. 2015;63:1245-6.
- **Slide 11:** https://www.mass.gov/doc/sharps-injuries-among-hospital-workers-in-massachusetts-2021-2022/download
- **Slide 12:** https://stacks.cdc.gov/view/cdc/224883
- **Slide 15:** https://www.cdc.gov/hepatitis-b/hcp/infection-control/table-1.html
- **Slide 19:** https://www.cdc.gov/hepatitis-c/hcp/infection-control/index.html
- **Slide 21:** https://www.hiv.uw.edu/go/screening-diagnosis/acute-recent-early-hiv/core-concept/all
- **Slide 22:** Figure 3. Timing of HIV RNA and HIV Antibodies following HIV Acquisition

  Colored circles indicate the typical time for first detection of a positive test after acquisition of HIV. Illustration by David H. Spach, MD.
- **Slide 27:** Kofman AD, Struble KA, Heneine W, et al. 2025 US Public Health Service Guideline for the Management of Occupational Exposures to Human Immunodeficiency Virus and Recommendations for Post-exposure Prophylaxis in Healthcare Settings. Infection Control & Hospital Epidemiology 2015;1-11.

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# Questions?