

Immunizations for Preventable Diseases in Adults and Adolescents Living with HIV (Last updated April 26, 2021; last reviewed April 26, 2021)

Overview

The Advisory Committee on Immunization Practices (ACIP) recommends immunizing persons with HIV (PWH) similarly to the general population with a few key exceptions:

- Safety concerns: Many live virus vaccines are contraindicated in PWH
 - For any CD4 count
 - Live attenuated influenza (LAIIV)
- For CD4 count <200 cells/mm³ or uncontrolled HIV
 - Measles
 - Mumps
 - Rubella
 - Varicella (VAR)
 - Live attenuated typhoid Ty21a
 - Yellow fever
- Concerns about higher incidence of vaccine-preventable disease: The following have specific recommendations related to HIV status:
 - Hepatitis A
 - Hepatitis B
 - MenACWY
 - Pneumococcal vaccine

The National Institutes of Health (NIH)/Infectious Diseases Society of America (IDSA)/ Centers for Disease Control and Prevention (CDC) recommendations described here may differ from ACIP recommendations when the committees interpret data differently, or when one guideline has been updated more recently than the other.

- Recombinant zoster vaccine (RZV, Shingrix) is recommended in this NIH/IDSA/CDC guideline for all persons with HIV age 50 years and older. ACIP currently has no recommendation regarding the use of RZV in PWH.

Specific Immunizations

Hepatitis A

See hepatitis A virus (HAV) section for detailed guidance for immunization against HAV, as well as evidence summary.

Summary of Recommendations

For vaccination

- Administer a two-dose series (dosing interval depends on the vaccine used: at 0 and 6–12 months for Havrix[®] or 0 and 6–18 months for Vaqta[®]) of single-antigen hepatitis A vaccine (HepA) or a three- or four-dose series (0, 1, and 6 months or days 0, 7, 21–30, and 12 months) of the combined hepatitis A and hepatitis B vaccine (HepA-HepB, Twinrix[®]) to any person without evidence of immunity to HAV (and for the combined vaccine, without evidence of immunity to HAV or HBV). **(AIII)**
- Assess antibody response 1 to 2 months after completion of the series. If negative, revaccinate when CD4 cell counts >200 cells/mm³. **(BIII)**
- PWH presenting with CD4 cell count <200 cells/mm³ with ongoing risk for HAV should be immunized and assessed for antibody response 1 to 2 months after completion of the series. For PWH without risk factors, waiting for CD4 >200 cells/mm³ is an option. Assess antibody response 1 to 2 months after completion of the series. If negative, revaccinate when CD4 cell counts are >200 cells/mm³. **(BIII)**

For pre-exposure prophylaxis (travel)

- For PWH who are non-immune and are traveling within 2 weeks to countries with endemic HAV, consider administering IgG 0.1 mL/kg if duration of travel is <1 month. If duration of travel is 2 months or less, then administer IgG 0.2 mL/kg. If duration of travel is ≥2 months, IgG 0.2 mL/kg should be repeated every 2 months.

For post-exposure prophylaxis

- For PWH who are non-immune, administer HAV vaccine and IgG 0.1 mL/kg simultaneously in different anatomical sites as soon as possible, ideally within 2 weeks of exposure.

Hepatitis B

See hepatitis B virus (HBV) section for detailed guidance for immunization against HBV, as well as evidence summary.

Summary of Recommendations

For vaccination

- For PWH who are non-immune to HBV (surface antibody titer negative), and do not have chronic HBV infection (surface antigen negative), administer a three-dose series of single-antigen hepatitis B vaccine (Recombivax[®] or Engerix[®]) or combined HepA-HepB at 0, 1, and 6 months (alternate dosing intervals are available). **(AII)**
- The U.S. Food and Drug Administration (FDA) recently approved a novel recombinant hepatitis B vaccine that uses a toll-like receptor 9 immunostimulatory adjuvant (HepB-CpG, Heplisav-B[®]); however, this vaccine has not yet been evaluated in PWH for whom no specific recommendations presently exist. If a two-dose vaccine at 0 and 1 month is preferred, Heplisav-B[®] is an option for vaccinating PWH. **(CIII)**
- PWH presenting with CD4 cell count <200 cells/mm³ with ongoing risk for HBV should be immunized and assessed for antibody response 1 to 2 months after completion of the series. For PWH without risk factors, waiting for CD4 >200 cells/mm³ is an option.
- Assess antibody response (anti-HBs) 1 to 2 months after completion of the vaccine series.
- For PWH who do not respond to a complete HepB vaccination series, administer a four-dose revaccination series using double doses **(BI)** or consider Heplisav-B[®] **(CIII)**.
- For individuals with isolated anti-HBc, vaccinate with one standard dose of HBV vaccine and check anti-HBs titers 1 to 2 months afterward. If the anti-HBs titer is ≥100 IU/mL, no

further vaccination is needed. If the titer is <100 IU/mL, then complete another series of HBV vaccine (single-dose or double-dose) followed by anti-HBs testing. **(BII)** If titers are not available, then give a complete vaccine series followed by anti-HBs testing.

For post-exposure prophylaxis

- For exposed persons who have been previously vaccinated with a complete HepB vaccine series and have documented antibody response, no additional vaccine is needed.
- For exposed persons who have received a complete HepB vaccine series without documentation of antibody response, administer a single dose of HepB vaccine.
- For exposed persons who have not received any HepB vaccine or have not received a complete HepB vaccine series, administer/complete HepB vaccine series and administer one dose of hepatitis B immune globulin (HBIG) at a separate anatomical site as soon as possible after exposure (ideally within 24 hours, but up to 7 days after percutaneous exposure and up to 14 days after sexual exposure).
- For exposed non-immune PWH on tenofovir or lamivudine, HBIG may not be necessary.

Human papillomavirus

See human papillomavirus (HPV) prevention section for detailed guidance for immunization against HPV, as well as evidence summary.

Summary of Recommendations

- Routine HPV vaccination is recommended for PWH. Ideally the series should be initiated at age 11 or 12 years, but may be started as early as age 9 years. For all PWH aged 13–26 years who were not vaccinated previously, regardless of gender, administer three doses of the recombinant HPV nonavalent vaccine at 0, 1–2, and 6 months. The two-dose series **is not recommended** in PWH. **(AIII)**
- For PWH aged 27–45 not adequately vaccinated previously, HPV vaccine is not routinely recommended; instead, shared clinical decision-making regarding HPV vaccination is recommended.
- For pregnant persons, delay HPV vaccination until after delivery; pregnancy testing is not routinely recommended before administering HPV vaccine.
- For patients who have completed a vaccination series with the recombinant HPV bivalent or quadrivalent vaccine, some experts would consider additional vaccination with recombinant HPV nonavalent vaccine, but data are lacking to define the efficacy and cost-effectiveness of this approach. **(CIII)**

Influenza

Summary of recommendations¹ :

- For all adults and adolescents with HIV, administer age-appropriate inactivated influenza vaccine or recombinant influenza vaccine annually. **(AI)**
- For pregnant PWH, administer inactivated influenza or recombinant vaccine at any time during pregnancy. **(AI)**
- The live attenuated influenza vaccine (LAIV) administered via nasal spray **is contraindicated** in PWH. **(AIII)**
- High-dose and adjuvanted influenza vaccines are approved as options for PWH aged 65 years or older. **(AIII)**

Evidence Summary

Influenza is a common respiratory disease in adults and adolescents. Annual epidemics of seasonal influenza typically occur in the United States between October and April. Influenza A and B are most frequently implicated in human epidemics. Influenza A viruses are categorized into subtypes based on characterization of two surface antigens: hemagglutinin (HA) and neuraminidase (NA). Although vaccine-induced immunity to the surface antigens HA and NA reduces the likelihood of infection,^{2,3} the frequent emergence of antigenic variants through antigenic drift⁴ (point mutations and recombination events within a subtype) is the virologic basis for seasonal epidemics and necessitates revaccination each season.⁵

Some studies of influenza have noted higher hospitalization rates⁶⁻⁹ and increased mortality^{9,10} among PWH; however, these findings have not been observed in all settings.¹¹ Increased morbidity may be greatest for PWH not on antiretrovirals or with advanced disease. PWH are at high risk of serious influenza-related complications (<https://www.cdc.gov/flu/highrisk/hiv-flu.htm>).

In general, PWH with minimal AIDS-related symptoms and normal or near-normal CD4+ T-lymphocyte cell counts who receive inactivated influenza vaccine develop adequate antibody responses.¹²⁻¹⁴ Among persons with low CD4+ T-lymphocyte cell counts or who have advanced HIV disease, inactivated influenza vaccine might not induce protective antibody titers.¹⁴⁻¹⁶ In one study, markers of inflammation in older people (≥ 60 years) with HIV were associated with lower post-vaccination influenza antibody titers.¹⁷ In people with HIV, a second dose of vaccine does not improve immune response,^{15,18} and intradermal influenza vaccine dosing did not improve the immune response compared with intramuscular dosing.¹⁹

Two clinical studies have evaluated influenza vaccine efficacy in PWH. In an investigation of an influenza A outbreak at a residential facility for PWH, vaccine was most effective at preventing influenza-like illness among persons with >100 CD4+ cells/mm³ and among those with HIV RNA $<30,000$ copies/mL.⁶ In a randomized placebo-controlled trial conducted in South Africa among 506 PWH, including 349 persons on antiretroviral treatment and 157 who were antiretroviral treatment-naïve, efficacy of trivalent inactivated influenza vaccine for prevention of culture- or RT-PCR–confirmed influenza illness was 75% (95% confidence interval [CI], 9% to 96%).²⁰

Several clinical studies have also evaluated the immunogenicity of influenza vaccine in PWH. In a randomized study comparing the immunogenicity of high-dose (60 mcg of antigen per strain) versus standard-dose (15 mcg of antigen per strain) trivalent inactivated influenza vaccine among 195 adults with HIV aged ≥ 18 years (10% of whom had CD4 T-lymphocyte cell counts <200 cells/mm³), seroprotection rates were higher in the high-dose group for influenza A (96% versus 87%; $P = 0.029$) and influenza B (91% versus 80%; $P = 0.030$).²¹ However, in a comparative study of 41 children and young adults aged 3–21 years with cancer or HIV, high-dose trivalent inactivated influenza vaccine was no more immunogenic than the standard dose among the recipients with HIV.²²

Optimally, influenza vaccination should occur before onset of influenza activity in the community, because it takes about 2 weeks after vaccination for protective antibodies to develop.¹ Health care providers should offer vaccination by the end of October if possible, and vaccination should continue to be offered as long as influenza viruses are circulating.

Although booster doses can make the influenza vaccine more effective, that benefit is limited to specific groups such as solid organ transplant recipients.²³ One study in PWH assessed the effectiveness of a two-dose regimen of inactivated influenza virus vaccine and found that the second dose of vaccine did not significantly increase the frequency or magnitude of antibody responses.¹⁸ Based on this study, influenza booster immunizations are not recommended for PWH.

Many licensed injectable influenza vaccine options are available, with no recommendation favoring one product over another.¹ Influenza vaccines are either trivalent (two influenza A components and one influenza B component) or quadrivalent (two A components and two B components) with formulations that change from season to season. Information on currently available influenza vaccines is available at <https://www.cdc.gov/flu/>.

[cdc.gov/mmwr/volumes/69/rr/rr6908a1.htm?s_cid=rr6908a1_w](https://www.cdc.gov/mmwr/volumes/69/rr/rr6908a1.htm?s_cid=rr6908a1_w). Adults aged ≥ 65 years can receive standard inactivated influenza vaccine, high-dose inactivated influenza vaccine,²⁴ adjuvanted inactivated influenza vaccine,²⁵ or recombinant influenza vaccine,²⁶ each of which has been studied in this age group.

Although quadrivalent live attenuated influenza vaccine (LAIV4) was available during the 2018–19 influenza season, it is contraindicated for people with HIV because of the paucity of safety data and the availability of alternative vaccines.¹ Even though unintentional administration of LAIV4 to adults with HIV has been well tolerated,²⁷ it is not recommended for PWH.

Inactivated influenza vaccine can be administered to persons receiving influenza antiviral drugs for treatment or chemoprophylaxis. Concurrent administration of influenza vaccine does not interfere with the immune response to other inactivated vaccines or to live vaccines.

Measles, mumps, and rubella vaccination

Summary of Recommendations

For vaccination

- Administer two doses of measles, mumps, and rubella vaccine (MMR) at least 1 month apart to persons with a CD4+ T-lymphocyte count ≥ 200 cells/mm³ and who have no evidence of immunity to measles, mumps, and rubella (evidence of immunity is defined as patient was born before 1957, and/or had documentation of receipt of MMR, and/or had no laboratory evidence of immunity or disease). **(AIII)**
- The MMR vaccine is **contraindicated** during pregnancy.
- Persons of childbearing potential who get the MMR vaccine should wait 4 weeks before getting pregnant.
- For pregnant persons without immunity to rubella, **delay immunization until after pregnancy**, then administer two doses of the MMR vaccine at least 1 month apart if the CD4+ T-lymphocyte count is ≥ 200 cells/mm³. **(AIII)**
- If no serologic evidence of immunity after two doses of MMR vaccine, consider repeating the 2-dose MMR series, especially if vaccinated while not virologically suppressed **(CIII)**.
- **Do not administer** MMR vaccine to PWH with CD4+ T-lymphocyte count < 200 cells/mm³. **(AIII)**

For post-exposure prophylaxis

- For measles exposure of non-immune individuals with CD4 counts > 200 cells/mm³, administer the MMR vaccine within 72 hours of exposure **or** immunoglobulin (IG) within 6 days of exposure. Do not administer the MMR vaccine and IG simultaneously.
- For measles exposure of non-immune individuals with CD4 counts < 200 cells/mm³ or those who are pregnant, administer IG within 6 days of exposure.

Evidence Summary

Measles is particularly virulent in the immunocompromised host, with a reported mortality rate as high as 40% in persons with advanced HIV.²⁸ Recently, measles outbreaks have occurred across the United States. From January 1 to October 3, 2019, 1,250 individual cases of measles were confirmed in 31 states; the most cases in 25 years. Current information regarding outbreaks can be found on the CDC website: <https://www.cdc.gov/measles/cases-outbreaks.html>. Measles is a highly contagious and potentially life-threatening disease.

With a resurgence of measles both domestically²⁹ and globally,³⁰ PWH should be assessed for immunity. Acceptable evidence of immunity includes being born before 1957, documented evidence of two doses of the MMR vaccine, or presence of positive antibody titers.

Individuals who do not fulfill any criteria for immunity and have CD4 count ≥ 200 cells/mm³ should receive two doses of MMR separated by at least 28 days. The combination measles, mumps, rubella, and varicella (MMRV) vaccine has not been studied in immunocompromised hosts and should **not** be administered to PWH.

Several studies from the 1990s found that approximately 90% to 95% of adults with HIV were immune to measles.³¹⁻³³ In these studies, serostatus did not vary by CD4 T-lymphocyte cell count, suggesting PWH retained protective immunity even in the context of advanced disease. However, in a more recent study, the measles seroprevalence rate was 70.3%.³⁴ Similarly, PWH appear to retain immunity to mumps and rubella even after acquisition of HIV.³⁴

MMR vaccine is **contraindicated** for PWH with CD4+ < 200 cells/mm³ as MMR vaccine is a live-attenuated formulation that has been linked to fatal cases of measles-associated pneumonitis following administration to PWH with low CD4 counts.^{35,36} For PWH with CD4 ≥ 200 cells/mm³, the vaccine has been shown to be safe, though antibody response may be lower than for patients without HIV.^{34,37,38}

For more detailed information regarding post-exposure prophylaxis, please see <https://www.cdc.gov/measles/hcp/index.html>.

Meningococcal vaccination

Summary of Recommendations

- Administer quadrivalent meningococcal conjugate vaccine, either MenACWY-D (Menactra[®]) or MenACWY-CRM (Menveo[®]), to all PWH age ≥ 2 months. **(AIII)**
- For PWH receiving primary vaccination, administer two doses given at least 8 weeks apart.
- For individuals with HIV who have been previously vaccinated and are age ≥ 7 years, repeat vaccination every 5 years throughout life. **(BIII)**
- Serogroup B meningococcal vaccination (MenB) is not routinely indicated for adults and adolescents with HIV at this time.

Evidence Summary

Meningococcal meningitis, caused by *Neisseria meningitidis*, is the most common cause of bacterial meningitis among children and young adults in the United States. Surveillance data collected during 1998–2007 identified 2,262 cases of meningococcal disease from a sample of 13% of the U.S. population from several states. Two quadrivalent meningococcal conjugate vaccine targeted against serogroups A, C, Y, and W-135 (MenACWY-D or MenACWY-CRM) are licensed for use in the United States and are recommended for all adolescents aged 11–18 years and persons aged 2–55 who are at increased risk for disease.

A growing body of evidence supports an increased risk of meningococcal disease in PWH. Studies have shown a 5- to 24-fold increased risk of meningococcal disease in PWH compared with persons without HIV; low CD4 count and high HIV viral load are associated with increased risk.³⁹ The average annual incidence rate of invasive meningococcal disease (IMD) was 0.39 cases per 100,000 persons. PWH with lower CD4 counts are at higher risk of invasive disease.⁴⁰

Safety and immunogenicity of MenACWY-D vaccine have been evaluated only in PWH aged 11–24 years. Patients with CD4% $\geq 15\%$ received either one or two doses (at 0 and 24 weeks) of vaccine, and those with CD4% $< 15\%$ received two doses (at 0 and 24 weeks). Among PWH who received one dose of vaccine, 21% to 63% developed antibody titer of $\geq 1:128$ at 72 weeks after vaccination. Antibody responses at 72 weeks

in individuals with CD4% < 15% were less robust, with only 6–28% achieving titers $\geq 1:128$.⁴¹ Local site reactions, such as pain and tenderness at injection site, were uncommon (3.1%) as were grade 3 or greater events (2.2%). No vaccine-related deaths or cases of meningitis were noted. No safety or immunogenicity studies are available for MenACWY-CRM in PWH, and clinical outcome data for both vaccines in PWH are lacking.

For PWH aged ≤ 56 years, either conjugate vaccine (MenACWY-D (Menactra[®]) or MenACWY–CRM (Menveo[®])) is recommended. The meningococcal polysaccharide vaccine (MPSV4 (Menomune[®])) is the only *licensed* vaccine for persons ≥ 56 years of age; however, the efficacy of MPSV4 in PWH has not been evaluated. Therefore, Menactra[®] or Menveo[®] are recommended for all adults with HIV, regardless of age.

Serogroup B MenB is not routinely indicated for adults and adolescents with HIV at this time. MenB vaccine may be administered to adolescents and young adults with HIV aged 16–23 years (preferred range, ages 16–18 years) for short-term protection against most strains of serogroup B meningococcal disease and for patients at increased risk (e.g., those living in dormitories or barracks) and during outbreaks. Those with functional or anatomic asplenia should also be vaccinated (<https://www.cdc.gov/vaccines/adults/rec-vac/health-conditions/asplenia.html>). Two MenB vaccines are available, MenB-4C (Bexsero[®]; two-dose series given at 0 and 1 month and MenB-FHbp (Trumenba[®]; PWH should receive the three-dose series given 0, 1–2, and 6 months and not the two-dose option). MenB vaccines are not interchangeable; the same product must be used for all doses in the series.

Urban outbreaks of meningococcal meningitis have been reported among men who have sex with men (MSM) in the United States, in men both with and without HIV. Several outbreaks were associated with clubs and bathhouses. Some public health jurisdictions now recommend meningococcal vaccine for all MSM, regardless of HIV status; however, ACIP has not adopted this recommendation for MSM without HIV.⁴²

Pneumococcal vaccination

See Bacterial Pneumonia prevention section for detailed guidance for immunization against pneumococcal disease, as well as the evidence summary.

Summary of Recommendations

- For PWH aged <65 years, administer 13-valent pneumococcal conjugate vaccine (PCV13) **(AI)**, followed by a dose of 23-valent pneumococcal polysaccharide vaccine (PPSV23) at least 8 weeks later **(AII)**. Administer a second dose of PPSV23 at least 1 year after PCV13 and at least 5 years after the first dose of PPSV23. **(BIII)**
- For PWH aged ≥ 65 years, administer PCV13, if they have not already received it, and a dose of PPSV23 at least 8 weeks after PCV13 and at least 5 years after the last dose of PPSV23. For PWH who have previously received PPSV23, administer PCV13 **(AII)** at least 1 year after the last dose of PPSV23. **(BIII)**

Tetanus, diphtheria, and pertussis vaccination

Summary of Recommendations

- Administer Tdap once if PWH has not been vaccinated at age 11 or older, and then Td or Tdap every 10 years thereafter **(AII)**
- For pregnant PWH, administer one dose of Tdap during each pregnancy, preferably between 27 weeks and 36 weeks gestation. **(AIII)**
- For adolescent and adult PWH who have not received primary vaccination series for tetanus, diphtheria, or pertussis: Administer one dose Tdap followed by one dose Td or Tdap at least

4 weeks after Tdap, and another dose Td or Tdap 6 months to 12 months after the last Td or Tdap. Tdap can be substituted for any Td dose but is preferred as first dose. **(AIII)**

Evidence Summary

Antibody response to tetanus and diphtheria vaccination varies by CD4 count. For individuals with advanced HIV and low CD4 counts, immunologic response is attenuated for both tetanus and diphtheria when compared to HIV-uninfected controls.^{43, 44} For persons with CD4 counts >300 cells/mm³, antibody response to tetanus vaccination is similar to the general population, whereas response to diphtheria remains diminished.⁴³⁻⁴⁵ Limited data exist on the efficacy of pertussis vaccination in this population.

Two Tdap vaccines for individuals aged ≥10 years are available in the United States (Adacel[®] and Boostrix[®]). Both vaccines are inactivated and considered safe to administer at any CD4 count. Tetanus vaccination has been linked to transient upregulation of HIV replication,^{14, 46} but no studies suggest any negative effect on HIV disease progression, and the potential risk of increased HIV replication should not impact timing of immunization.

Persons with HIV should receive vaccination for tetanus, diphtheria, and pertussis on the same schedule as individuals without HIV. All adults not previously vaccinated should receive a single dose of the combination tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) vaccine, followed by a tetanus toxoid plus reduced diphtheria (Td) or Tdap booster every 10 years.

Varicella vaccination

See Varicella-Zoster Virus Disease prevention section for detailed guidance for immunization against varicella, as well as the evidence summary.

Summary of Recommendations

- PWH with any of the following have presumed immunity to varicella: receipt of two doses of varicella vaccine (VAR or MMRV), diagnosis of varicella or herpes zoster (shingles) by a health care provider, or laboratory evidence of immunity or disease.
- For PWH who are varicella non-immune with CD4 count ≥200 cells/mm³, administer two doses of varicella vaccine (VAR) 3 months apart. **(BIII)**
- VAR is **contraindicated** for PWH with CD4+ <200 cells/mm³. **(AIII)**

Herpes zoster vaccination

See Varicella-Zoster Virus Disease prevention section for detailed guidance for immunization against zoster, as well as evidence summary.

Summary of Recommendations

- For PWH aged ≥50 years, administer recombinant zoster vaccine (RZV, Shingrix), two doses at 0 and 2 months. **(AIII)**
- Consider delaying vaccination until the patient is virologically suppressed on ART **(CIII)** and wait for CD4 count >200 cells/mm³ to maximize response to vaccine. **(CIII)**
- RZV is not FDA-approved for persons aged <50 years.
- If PWH has already received ZVL, re-vaccination with an RZV 2-dose series should be given.

Vaccine	Indication	Recommendations	Additional Comments	ACIP Recommendations
Hepatitis A (HAV)	HAV susceptible with HIV infection (AIII)	<p>2-dose series of either single antigen vaccine:</p> <ul style="list-style-type: none"> Havrix® 1.0 mL IM (0, 6–12 months) (AII) <p>OR</p> <ul style="list-style-type: none"> Vaqta® 1.0 mL IM (0, 6–18 months) (AIII) <p>Alternative for individuals susceptible to both hepatitis A and hepatitis B:</p> <ul style="list-style-type: none"> Twinrix®: 1.0 mL IM <p>3-dose series (0, 1, 6 months)</p> <p>4-dose series (0, 7, 21–30 days, 12 months) (AII)</p>	<p>Assess antibody response (total or IgG anti-HAV) 1–2 months after completion of the series, and if negative, revaccinate, preferably after the CD4 count is ≥ 200 cells/mm³ (BIII)</p>	No difference in recommendations.
	Post exposure prophylaxis	Administer HAV vaccine and HepA IgG (0.1 mg/kg) simultaneously in different anatomical sites as soon as possible within 2 weeks of exposure to HAV in persons who are non-immune.		
Hepatitis B (HBV)	<p>HBV susceptible and never vaccinated</p> <p>(i.e. anti-HBs <10 mIU/mL)</p>	<p>Patients may receive any of the following single-antigen vaccines:</p> <ul style="list-style-type: none"> Recombivax® : 3-dose series (0, 1, 6 months) 10 µg/mL IM (AII) <p>OR</p> <ul style="list-style-type: none"> Engerix® : 3-dose series (0, 1, 6 months) 20 µg in 1.0 mL IM (AII) <p>OR</p> <ul style="list-style-type: none"> Heplisav® : 2-dose series (0, 1 month) 20 µg in 0.5 mL IM (CIII) <p>Alternative for individuals susceptible to both hepatitis A and hepatitis B:</p> <ul style="list-style-type: none"> Twinrix® : 1.0 mL IM <p>3-dose series (0, 1, 6 months)</p> <p>4-dose series (0, 7, 21–30 days, 12 months) (AIII)</p>	<ul style="list-style-type: none"> Assess antibody response (anti-HBs) 1–2 months after completion of the series Vaccinate individuals with isolated anti-HBc with one standard dose of HepB (BIII) and check anti-HBs titers 1–2 months afterward. If anti-HBs >100 IU/mL, no further vaccination is needed, but if the titer is <100 IU/mL, then vaccinate with a complete series of HepB (single-dose or double-dose) followed by anti-HBs testing (BII) Safety and efficacy of Heplisav® has not yet been studied in persons with HIV. If a 2-dose vaccine is preferred, Heplisav® is an option. If there is a significant delay between doses, there is no need to restart the series 	No difference in recommendations.

Vaccine	Indication	Recommendations	Additional Comments	ACIP Recommendations
Hepatitis B (HBV) continued	Vaccine non-responder (if anti-HBs <10 mIU/mL after 3-dose series)	<p>May consider 4-dose double dose of either Recombivax® or Engerix® (BI)</p> <p>Repeat 3-dose re-vaccination series of either Recombivax® or Engerix®. (BIII)</p> <p>May considering delaying repeat vaccination until after the CD4 count is ≥200 cells/mm³. (CIII)</p>		
	Post exposure prophylaxis	<ul style="list-style-type: none"> For exposed persons who have been previously vaccinated with complete series and have documented antibody response, no additional vaccine needed. For exposed persons who have received complete series without documentation of antibody response, administer a single dose of HepB vaccine. For exposed persons who have not received vaccine or have not received complete series, administer/complete HepB vaccine series and administer dose of hepatitis B immune globulin (HBIG) at a separate anatomical site as soon as possible after exposure (ideally within 24 hours, but up to 7 days after percutaneous exposure and up to 14 days after sexual exposure). 		
Human papillomavirus (HPV)	Adults and adolescents through age 26	<p>Recombinant 9-valent human papillomavirus vaccine (Gardasil 9®) 0.5 mL IM in a 3-dose series</p> <p>(0, 1 months and 6 months)</p>	<p>If there is a significant delay between doses, there is no need to restart the series.</p> <p>May consider vaccination in persons ages 27–45 years.</p>	No difference in recommendations.
	Adults and adolescents who previously received bivalent or quadrivalent vaccine	<p>For patients who have completed a vaccination series with the recombinant bivalent or quadrivalent vaccine, no recommendations exist for additional vaccinations; some experts would give an additional full series of recombinant 9-valent vaccine, but no data currently define who might benefit or how cost effective this approach might be. (CIII)</p>	<p>Delay until after pregnancy</p>	

Vaccine	Indication	Recommendations	Additional Comments	ACIP Recommendations
Influenza	All	<p>One dose of age-appropriate inactivated influenza vaccine (IIV) or recombinant influenza vaccine (RIV) annually. (AI)</p> <p>Live-attenuated influenza vaccine (LAIV) is contraindicated. (AIII)</p>	<p>Information on currently available influenza vaccines is available at https://www.cdc.gov/mmwr/volumes/69/rr/rr6908a1.htm?s_cid=rr6908a1_w</p> <p>Influenza vaccines are either trivalent or quadrivalent, with formulations that change from season to season.</p> <p>In addition to standard IIV formulations, adults age ≥ 65 years may use high dose IIV (Fluzone[®] High-Dose) and adjuvanted IIV (FLUAD[™]).</p> <p>Persons age ≥ 18 years also may use recombinant influenza vaccine (RIV; Flublok[®] Quadrivalent).</p> <p>For persons with egg allergy, use IIV or RIV appropriate for age (if the allergy is more severe than hives, give the vaccine in a medical setting appropriate to manage severe allergic reaction)</p>	No difference in recommendation.
Measles, mumps, and rubella (MMR)	CD4 count ≥ 200 cells/mm ³ and no evidence of immunity to measles, mumps, or rubella	<p>2-dose series of measles, mumps, and rubella vaccine (MMR) at least 1 month apart. (AIII)</p> <p>MMR is contraindicated if CD4 count < 200 cells/mm³.</p>	<p>Evidence of immunity to measles, mumps, or rubella is—</p> <ul style="list-style-type: none"> • born before 1957, or • documentation of receipt of MMR, or • laboratory evidence of immunity or disease for each pathogen <p>- MMR vaccine is contraindicated during pregnancy.</p> <p>- For pregnant persons without immunity to rubella, after pregnancy administer 2 doses of MMR vaccine at least 1 month apart if CD4 count > 200 cells/mm³. (AIII)</p>	No difference in recommendation.
	Post-exposure prophylaxis	<ul style="list-style-type: none"> • For measles non-immune individuals with CD4 counts > 200 cells/μl, administer MMR vaccine within 72 hours of exposure or immunoglobulin (IG) within six days of exposure. Do not administer MMR vaccine and IG simultaneously. • For measles non-immune individuals with CD4 counts < 200 cells/μl or those who are pregnant, administer IG. 		

Vaccine	Indication	Recommendations	Additional Comments	ACIP Recommendations
Meningococcus Serogroup A, C, W, Y (MenACWY)	Not received any polyvalent meningococcal vaccine	Menactra® or Menveo®: 2-dose series given at least 8 weeks apart (AII) Revaccinate with a dose of same MenACWY vaccine every 5 years (BIII)	MenACWY vaccine is routinely recommended MenB vaccine is not routinely recommended; only recommended if at increased risk (see below).	No difference in recommendations.
Meningococcus Serogroup B	Serogroup B meningococcal vaccination (MenB) is not routinely indicated for individuals with HIV, except for those at increased risk for serogroup B meningococcal disease (asplenia, complement deficiency, eculizumab use, occupational exposure)	2-dose series of Bexsero® or 3-dose series of Trumenba® Even if they are not at increased risk for serogroup B meningococcal disease, MenB may be given to adolescents and young adults ages 16–23 years (preferred age range, 16–18 years)	Two MenB vaccines are available and not interchangeable, MenB-4C (Bexsero®) and MenB-FHbp (Trumenba®).	No difference in recommendations.
Pneumococcal	Did not receive any pneumococcal vaccine	13-valent pneumococcal conjugate vaccine (PCV13, Prevnar®): 0.5 mL IM x 1 (AI) Followed <u>at least 8 weeks</u> later by 23-valent pneumococcal polysaccharide vaccine (PPV23, Pneumovax®): 0.5 mL IM x 1 (AII)	Administer PCV13 to all persons with HIV, regardless of CD4 count. (AII) In those who received PCV13 when the CD4 count <200 cells/mm ³ , some experts may choose to defer PPV23 until CD4 count is >200 cells/mm ³ to optimize vaccine efficacy. (BIII)	No difference in recommendations.
	Received PPV23 previously	Give one dose of PCV13 <u>at least 1 year</u> after the last receipt of PPV23 (AII)		
	<u>Re-vaccination</u> <ul style="list-style-type: none"> If age 19–64 years and ≥5 years since the first PPV23 dose If age ≥65 years and if ≥5 years since the previous PPV23 dose 	Repeat PPV23 five (5) years after the first, then another dose at/after age 65 (BIII)		

Vaccine	Indication	Recommendations	Additional Comments	ACIP Recommendations
Polio	Not routinely recommended (AIII)			No difference in recommendations.
	Those at higher risk for exposure to poliovirus, such as those traveling to countries where polio is epidemic or endemic, can be vaccinated with inactivated polio vaccine (IPV). (CIII)	3 doses IPV IM at 0, 1–2 months and third dose given 6–12 months after 2nd dose (CIII)		
	Previously vaccinated with 1–2 doses of vaccine	Give remaining doses of vaccine at recommended intervals. (CIII)		
Tetanus, diphtheria, and pertussis	Did not receive tetanus, diphtheria, and acellular pertussis vaccine (Tdap) at age 11 years or older	1 dose Tdap (Adacel® or Boostrix®, then Td or Tdap every 10 years (AII)	If indicated, give Tdap regardless of when the last dose of Td was given	No difference in recommendations.
	Pregnancy	Give Tdap preferably in early part of gestational weeks 27–36 1 dose of Tdap is indicated for each pregnancy	Give Td or Tdap booster every 10 years after Tdap	
Varicella (Chickenpox)	CD4 count ≥ 200 cells/mm ³ with no evidence of immunity to varicella	2-dose series of varicella vaccine (VAR) 3 months apart (BIII) VAR is contraindicated if CD4 count < 200 cells/mm ³ . (AIII)	Evidence of immunity to varicella is— <ul style="list-style-type: none"> documented receipt of 2 doses of VAR or MMRV, or diagnosis of varicella or zoster by a health care provider, or laboratory evidence of immunity or disease If vaccination results in disease because of vaccine virus, treatment with acyclovir is recommended. (AIII)	No difference in recommendations.
Herpes Zoster	Age ≥ 50 years, regardless of past episode of herpes zoster or receipt of attenuated zoster vaccine live (ZVL, Zostavax®) regardless of CD4 count	Give 2-dose series of recombinant zoster vaccine (RZV, Shingrix) IM 2–6 months apart (AIII)	Consider delaying vaccination until patient is virologically suppressed on ART (CIII) or wait for immune reconstitution in those who had a CD4 count < 200 cells/mm ³ (CIII) to maximize immunologic response to the vaccine. Do not give RZV during an acute episode of herpes zoster (AIII) .	ACIP has no specific zoster vaccination recommendations for PWH.

Immunizations for Travel				
Vaccine	Indication	Recommendations	Additional Comments	ACIP Recommendations
Cholera	<p>Not routinely recommended for most travelers (CIII).</p> <p>Age 18–64 years old with CD4 counts >200 cells/mm³ traveling to an area where cholera is epidemic or endemic within the past year</p>	<p>Lyophilized CVD 103-HgR (Vaxchora[®]) single oral dose at least 10 days prior to potential exposure. (CIII)</p>	<p>Safety and efficacy has not been established in individuals with HIV.</p> <p>No adverse effects reported with older formulation of vaccine in individuals with HIV infection without an AIDS diagnosis.</p>	<p>No current recommendations for individuals with HIV infection.</p>
Typhoid	<p>At risk of <i>Salmonella</i> serotype typhi infection (travel, intimate exposure to a chronic carrier, occupational exposure)</p> <p>Revaccination only if continued or renewed exposure to <i>Salmonella</i> typhi is expected</p>	<p>One dose Vi capsular polysaccharide vaccine (Typhim Vi[®]) via intramuscular injection – at least 1 week before exposure (AIII)</p> <p>Revaccinate every 2 years if risk re-mains. (BIII)</p> <p>The live attenuated oral typhoid vaccine [Vivotif[®]] is contraindicated in persons with HIV. (AIII)</p>	<p>Provide education on other preventive measures against foodborne illness in addition to typhoid vaccination (AIII)</p> <p>Safety of typhoid vaccination in pregnancy is unknown. Consider avoiding during pregnancy. (AIII)</p>	<p>ACIP has no position on the use of typhoid vaccine in persons with HIV except not to give immunocompromised persons the live attenuated vaccine.</p>
Yellow Fever (YF)	<p>Age ≤59 years and at risk for YF virus acquisition (travel to or live in areas at risk based on season, location, activities, and duration)</p>	<p>If indicated, provide vaccination at least 10 days prior to expected exposure.</p> <p>Age <59 years and asymptomatic with CD4 >500 cells/mm³: 1 dose of YF vaccine, revaccinate in >10 years if risk remains (BIII)</p> <p>Any age and asymptomatic with CD4 200–499 cells/mm³, YF vaccine may be considered depending on risk. (BIII)</p>	<p>Provide vaccination as an adjunct to other protective measures against mosquito bites.</p> <p>YF vaccine is contraindicated for persons with CD4 counts <200 cells/mm³. This recommendation is based on a theoretic increased risk for encephalitis in this population. (AII)</p> <p>Pregnancy and age ≥60 years may increase risk of complications from yellow fever vaccine administration.</p> <p>If international travel requirements rather than an increased risk for acquiring YFV infection are the only reason to vaccinate persons with HIV, excuse the person from vaccination and issue a medical waiver to fulfill health regulations.</p> <p>Closely monitor persons with HIV who have received YF vaccine for evidence of adverse events.</p> <p>In 2017, CDC reported a shortage of licensed yellow fever vaccine (YF-Vax) in the United States, which is ongoing. For more information, including advice about alternatives to YF-Vax, see this website: https://wwwnc.cdc.gov/travel/news-announcements/yellow-fever-vaccine-access</p>	<p>No difference in recommendations.</p>

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