Immunizations for Preventable Diseases in Adults and Adolescents with HIV

Updated: September 7, 2023
Reviewed: January 10, 2024

Overview

The Advisory Committee on Immunization Practices (ACIP) recommends immunizing people with HIV similarly to the general population, with a few key exceptions.

- The following live virus vaccines are contraindicated in people with HIV:
  - For any CD4 T lymphocyte (CD4) cell counts
    - Live attenuated influenza (LAIV)
  - For CD4 count <200 cells/mm^3 or uncontrolled HIV
    - Measles
    - Mumps
    - Rubella
    - Varicella (VAR)
    - Live attenuated typhoid Ty21a
    - Yellow fever
- The following vaccines have specific recommendations related to HIV status:
  - COVID-19
  - Hepatitis A (HAV)
  - Hepatitis B (HBV)
  - Meningococcus serogroup A, C, W, Y (MenACWY)
  - Pneumococcal vaccine

The National Institutes of Health (NIH)/Infectious Diseases Society of America/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.

Specific Immunizations

COVID-19 Vaccine

Whether people with HIV are at greater risk of acquiring SARS-CoV-2 infection is currently unknown. Data are emerging on the clinical outcomes of COVID-19 in people with HIV.

Worse outcomes for patients with HIV and COVID-19, including high COVID-19 mortality rates, have been reported in cohort studies from the United States, the United Kingdom, and South Africa.[1-10] HIV was independently associated with an increased risk of severe and critical COVID-19 in a large trial from the World Health Organization's Global Clinical Platform, which included data from 24 countries.[1] In a multicenter cohort study of 286 patients with HIV and COVID-19 in the United States, a lower CD4 count (i.e., <200 cells/mm^3) was associated with a higher risk for the composite endpoint of intensive care unit admission, invasive mechanical ventilation, or death. This increased risk was observed even in patients who had achieved virologic suppression of HIV.[2]

All adults and adolescents should get the COVID-19 vaccine regardless of their CD4 count or HIV viral load.[11] Those with severe immunosuppression may have a diminished immune response to the vaccine. Routine serologic testing following vaccination is not recommended.[11] For current COVID-19 vaccination recommendations, please visit CDC.gov or the NIH COVID-19 Treatment Guidelines.

Note: People with advanced or untreated HIV are considered moderately or severely immunocompromised. Advanced HIV is defined as people with CD4 count <200 cells/mm^3, a history of an AIDS-defining illness without immune reconstitution, or clinical manifestations of symptomatic HIV. Further information is available in the NIH COVID-19 Treatment Guidelines.

Hepatitis A Vaccine

See the "Hepatitis A virus (HAV)" section in the table below for detailed guidance on immunization against HAV.

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 **[AII]** or 0 and 6–18 months for Vaqta **[AIII]**) of single-antigen hepatitis A vaccine (HepA) or a three-dose series (0, 1, and 6 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) **(AII).**
- For travelers, some clinicians recommend a four-dose accelerated regimen (0, 7, 21–30 days, and 12 months) of HepA-HepB **(BII).**
- Assess antibody response 1 to 2 months after completion of the series. If negative, revaccinate when CD4 count is >200 cells/mm^3 **(BIII).**
- People with HIV presenting with CD4 count <200 cells/mm^3 with ongoing risk for HAV should be immunized and assessed for antibody response 1 to 2 months after completion of the series. For people with HIV without risk factors, waiting for a CD4 count >200 cells/mm^3 is an option. Assess antibody response 1 to 2 months after completion of the series. If negative, revaccinate when the CD4 count is >200 cells/mm^3 **(BIII).**

For Pre-exposure Prophylaxis (Travel)

- For people with HIV who are non-immune and are traveling within 2 weeks to countries with endemic HAV, consider administering immunoglobulin G (IgG) 0.1 mL/kg if duration of travel

is <1 month. If duration of travel is 1 to 2 months, 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 people with HIV 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 Vaccine

See the "Preventing Disease" section in Hepatitis B Virus (HBV) Infection for detailed guidance on immunization against HBV, as well as the evidence summary.

Summary of Recommendations

For Vaccination

- HepB vaccine intramuscular (IM) (Engerix-B 40 mcg [two injections of 20 mcg each] or Recombivax HB 20 mcg [two injections of 10 mcg each]) at 0, 1, and 6 months (these doses are considered a "double-dose" three-dose series) **(AII);** *or*
- Combined HepA and HepB vaccine (Twinrix) 1 mL IM as a three-dose series (at 0, 1, and 6 months) **(AII);** *or*
- Vaccine conjugated to CpG (Heplisav-B) IM at 0 and 1 months for vaccine-naive patients **(AII).**
- Anti-HBs should be obtained 1 to 2 months after completion of the vaccine series.

For Vaccine Nonresponders

- Revaccinate with a second double-dose, three-dose series of recombinant HBV vaccine (Engerix-B 40 mcg [two injections of 20 mcg each] or Recombivax HB 20 mcg [two injections of 10 mcg each]) **(BIII);*** *or*
- Revaccinate with two-dose series of HepBCpG (Heplisav-B) **(BIII).**
- For people with low CD4 count at the time of first vaccination series, some experts might delay revaccination until after a CD4 count ≥200 is achieved and sustained with ART **(CIII).**

For Post-exposure Prophylaxis

- For exposed people who have been vaccinated previously with a complete HepB vaccine series and have documented antibody response, no additional vaccine is needed.
- For exposed people who have received a complete HepB vaccine series without documentation of antibody response, administer a single dose of HepB vaccine.
- For exposed people 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 people with HIV on tenofovir or lamivudine, HBIG may not be necessary.

Human Papillomavirus Vaccine

See the "HPV Vaccine" section in Human Papillomavirus (HPV) Disease for detailed guidance on immunization against human papillomavirus (HPV), as well as the evidence summary.

Summary of Recommendations

- Routine HPV vaccination is recommended for people with HIV. Ideally, the series should be initiated at age 11 or 12 years but may be started as early as age 9 years. For all people with HIV aged 13 to 26 years who were not vaccinated previously, regardless of gender, administer three doses of the recombinant HPV nonavalent vaccine (Gardasil 9) at 0, 1 to 2, and 6 months **(AIII).** The two-dose series is **not recommended** in people with HIV.
- For people with HIV aged 27 to 45 years not adequately vaccinated previously, the HPV vaccine is not routinely recommended; instead, shared clinical decision-making regarding HPV vaccination is recommended.
- At present, vaccination with commercially available HPV vaccine is **not recommended** during pregnancy **(CIII).**
- For people 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 for defining the efficacy and cost-effectiveness of this approach **(CIII).**

Influenza Vaccine

Summary of Recommendations

- For all adults and adolescents with HIV, administer age-appropriate inactivated influenza vaccine or recombinant influenza vaccine annually **(AI).**
- For pregnant individuals with HIV, administer inactivated influenza or recombinant vaccine at any time during pregnancy **(AI).**
- LAIV administered via nasal spray **is contraindicated** in people with HIV **(AIII).**
- High-dose and adjuvanted influenza vaccines are recommended for people with HIV aged 65 years or older over standard-dose unadjuvanted vaccines **(AII).**[12]

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,[13,14] the frequent emergence of antigenic variants through antigenic drift[15] (i.e., point mutations and recombination events within a subtype) is the virologic basis for seasonal epidemics and necessitates revaccination each season.[16]

Some studies of influenza have noted higher hospitalization rates[17-20] and increased mortality[20,21] among people with HIV; however, these findings have not been observed in all settings.[22] Increased morbidity may be greatest for people with HIV not on antiretrovirals (ARV) or with advanced disease. People with HIV are at high risk of serious influenza-related complications. For more information, see the CDC's Flu & People Living with HIV webpage.

In general, people with HIV with minimal AIDS-related symptoms and normal or near-normal CD4 counts who receive inactivated influenza vaccine (IIV) develop adequate antibody responses.[23-25] Among people with a low CD4 count or who have advanced HIV disease, IIV might not induce protective antibody titers.[25-27] In one study, markers of inflammation in older people (≥60 years) with HIV were associated with lower post-vaccination influenza antibody titers.[28] In people with HIV, a second dose of vaccine does not improve immune response,[26,29] and intradermal influenza vaccine dosing did not improve the immune response compared with intramuscular dosing.[30]

Two clinical studies have evaluated influenza vaccine efficacy in people with HIV. In an investigation of an influenza A outbreak at a residential facility for people with HIV,[17] vaccination was most effective at preventing influenza-like illness among people with a CD4 count >100 cells/mm^3 and among those with HIV RNA <30,000 copies/mL. In a randomized placebo-controlled trial conducted in South Africa among 506 individuals with HIV, including 349 people on ARV treatment and 157 who were ARV treatment-naive, efficacy of trivalent IIV for prevention of culture- or RT-PCR–confirmed influenza illness was 75% (95% confidence interval, 9% to 96%).[31]

Several clinical studies also have evaluated the immunogenicity of influenza vaccine in people with HIV. In a randomized study[32] comparing the immunogenicity of high-dose (60 mcg of antigen per strain) versus standard-dose (15 mcg of antigen per strain) trivalent IIV among 195 adults with HIV aged ≥18 years (10% of whom had a CD4 count <200 cells/mm^3), seroprotection rates were higher in the high-dose group for influenza A (96% versus 87%; $P = 0.029$) and influenza B (91% vs. 80%; $P = 0.030$). However, in a comparative study of 41 children and young adults aged 3 to 21 years with cancer or HIV, high-dose trivalent IIV was no more immunogenic than the standard dose among the recipients with HIV.[33]

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.[12] 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.[34] One study in people with HIV assessed the effectiveness of a two-dose regimen of IIV and found that the second dose of vaccine did not significantly increase the frequency or magnitude of antibody responses.[29] Based on this study, influenza booster immunizations are **not recommended** for people with HIV.

Many licensed injectable influenza vaccine options are available, with no recommendation favoring one product over another.[12] Information on currently available influenza vaccines is obtainable

through the CDC recommendation, "Prevention and Control of Seasonal Influenza with Vaccines." For adults aged ≥65 years, high-dose IIV,[35] adjuvanted IIV,[36] or recombinant influenza vaccine[37] are preferentially recommended over standard-dose unadjuvanted vaccines based on data suggesting higher efficacy in preventing invasive pneumococcal disease in this age group.[38]

Influenza vaccines are quadrivalent (two A components and two B components) with formulations that change from season to season. Although a quadrivalent live attenuated influenza vaccine (LAIV4) is available, it **is contraindicated** for people with HIV because of the paucity of safety data and the availability of alternative vaccines.[12] Although unintentional administration of LAIV4 to adults with HIV has been well tolerated,[39] **it is not recommended** for people with HIV.

IIVs can be administered to people 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 Vaccine

Summary of Recommendations

For Vaccination

- Administer two doses of measles, mumps, and rubella vaccine (MMR) at least 1 month apart to people with a CD4 count ≥200 cells/mm^3 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 has laboratory evidence of immunity or disease) **(AIII).**
- The MMR vaccine **is contraindicated** during pregnancy.
- People of childbearing potential who get the MMR vaccine should wait 4 weeks before getting pregnant.
- For pregnant people without immunity to rubella, **delay immunization until after pregnancy,** and then administer two doses of the MMR vaccine at least 1 month apart if the CD4 count is ≥200 cells/mm^3 **(AIII).**
- If no serologic evidence of immunity exists after two doses of MMR vaccine, consider repeating the two-dose MMR series, especially if the person is vaccinated while not virologically suppressed **(CIII).**
- **Do not administer** MMR vaccine to people with HIV with CD4 count <200 cells/mm^3 **(AIII).**

For Post-exposure Prophylaxis

- For measles exposure of non-immune individuals with CD4 count >200 cells/mm^3, 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 count <200 cells/mm^3 or those who are pregnant, administer IG within 6 days of exposure.

Evidence Summary

Measles is a highly contagious and potentially life-threatening disease. Measles is particularly virulent in the immunocompromised host, with a reported mortality rate as high as 40% in people with advanced HIV.[40] 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 Measles Cases and Outbreaks.

With a resurgence of measles both domestically[41] and globally,[42] people with HIV 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/mm^3 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 people with HIV.

Several studies from the 1990s found that 90% to 95% of adults with HIV were immune to measles.[43-45] In these studies, serostatus did not vary by CD4 count, suggesting that people with HIV retained protective immunity even in the context of advanced disease. However, in a more recent study, the measles seroprevalence rate was 70.3%.[46] Similarly, people with HIV appear to retain immunity to mumps and rubella even after acquisition of HIV.[46]

The MMR vaccine **is contraindicated** for people with HIV with CD4 count <200 cells/mm^3 because the MMR vaccine is a live attenuated formulation that has been linked to fatal cases of measles-associated pneumonitis following administration to people with HIV with a low CD4 count.[47,48] For people with HIV with CD4 count ≥200 cells/mm^3, the vaccine has been shown to be safe, although antibody response may be lower than for patients without HIV.[46,49,50]

For more detailed information regarding post-exposure prophylaxis, please see Measles (Rubeola).

Meningococcal Vaccine

Summary of Recommendations

- Administer two doses of quadrivalent meningococcal conjugate vaccine at least 8 weeks apart to all people with HIV age ≥18 years **(AII).**
- For people with HIV receiving primary vaccination, administer two doses at least 8 weeks apart.
- For individuals with HIV who have been vaccinated previously and are age ≥7 years, repeat vaccination every 5 years throughout life **(BIII).**
- At this time, serogroup B meningococcal vaccination (MenB) is not routinely indicated for adults and adolescents with HIV.

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 from

1998 to 2007 identified 2,262 cases of meningococcal disease from a sample of 13% of the U.S. population from several states. All available formulations of meningococcal vaccine are inactivated. Two quadrivalent meningococcal conjugate (MenACWY) vaccines are currently licensed and available in the United States: (1) Meningococcal groups A, C, W, and Y oligosaccharide diphtheria CRM197 conjugate vaccine (MenACWY-CRM, Menveo); and (2) Meningococcal groups A, C, W, and Y polysaccharide tetanus toxoid conjugate vaccine (MenACWY-TT, MenQuadfi). Meningococcal groups ACWY polysaccharide diphtheria toxoid conjugate vaccine (MenACWY-D, Menactra) is no longer available. Quadrivalent meningococcal vaccination is recommended for all adolescents aged 11 to 18 years and people aged 2 to 55 years who are at increased risk for disease.

A growing body of evidence supports an increased risk of meningococcal disease in people with HIV. Studies have shown a 5- to 24-fold increased risk of meningococcal disease in people with HIV compared with people without HIV; low CD4 count and high HIV viral load are associated with increased risk.[51] The average annual incidence rate of invasive meningococcal disease was 0.39 cases per 100,000 people. People with HIV with a lower CD4 count are at higher risk of invasive disease.[52] In addition, a cohort study found that uptake of the MenACWY vaccine among people with a new diagnosis of HIV infection was low, and time to receipt of first vaccination was long.[53]

The safety and immunogenicity of MenACWY-D vaccine have been evaluated only in people with HIV aged 11 to 24 years. Patients with CD4% ≥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 people with HIV who received one dose of vaccine, 21% to 63% developed an antibody titer of ≥1:128 at 72 weeks after vaccination. Antibody responses at 72 weeks in individuals with CD4% <15% were less robust,[54] with only 6% to 28% achieving titers ≥1:128. 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 people with HIV, and clinical outcome data for both vaccines in people with HIV are lacking as well.

Menveo and MenQuadfi are recommended for all adults with HIV, regardless of age.

At this time, MenB is not routinely indicated for adults and adolescents with HIV. MenB vaccine may be administered to adolescents and young adults with HIV aged 16 to 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. Two MenB vaccines are available: MenB-4C (Bexsero; two-dose series given at 0 and 1 month) and MenB-FHbp (Trumenba; people with HIV should receive the three-dose series given at 0, 1–2, and 6 months, rather than 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 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 men who have sex with men, regardless of HIV status; however, ACIP has not adopted this recommendation for men who have sex with men without HIV.[55]

Mpox Vaccine

See the "Preventing Disease" section in Mpox for detailed guidance on immunization against mpox, as well as the evidence summary.

Summary of Recommendations

For Vaccination

- Mpox vaccination with live nonreplicating vaccinia vaccine, sold as JYNNEOS in the United States, should be offered to all people with HIV who have potential for mpox exposure or anticipate potential exposure to mpox per CDC interim clinical considerations **(BII),** as well as any other people with HIV who request vaccination **(CII).**
- JYNNEOS is the preferred vaccine before mpox exposure and is safe to use in people with HIV; administer JYNNEOS in two doses (0.1 mL ID or 0.5 mL SQ) 4 weeks (28 days) apart **(AII).**
- If the second dose is not administered during the recommended interval, it should be administered as soon as possible **(CIII).** There is no need to restart or add doses to the series if there is an extended interval between doses **(CIII).**
- People who had received smallpox vaccination more than 10 years ago should still receive two doses of JYNNEOS **(CIII).**
- Administration of live replicating vaccinia vaccines (i.e., ACAM2000) to pregnant, breastfeeding, or immunocompromised individuals, including people with HIV, **is contraindicated (AII).**

For Post-exposure Prophylaxis

- For unvaccinated people with HIV who experience a known or presumed exposure, administer a complete series of JYNNEOS as soon as possible, ideally within 4 to 14 days after exposure **(BII).**

For current information on the state of the outbreak and vaccination recommendation criteria, please visit the CDC's Mpox webpage. JYNNEOS has been demonstrated to be both safe for people with HIV and equally immunogenic compared with people without HIV.[56-58] However, these studies were limited to people who were virologically suppressed and had a CD4 count >100 cells/mm^3. Immunogenicity among people with HIV who are not virologically suppressed or have a lower CD4 count remains unknown.

Recent studies indicate that JYNNEOS is effective against mpox.[59-62] Matched case control study data indicate that vaccine effectiveness against symptomatic infection ranges from 36% to 75% after one dose to 66% to 89% after two doses.[62-65] However, all studies to date have had insufficient data to assess effectiveness of JYNNEOS against mpox by HIV status or CD4 count, and immunologic correlates of protection have not yet been established.

Pneumococcal Vaccine

See the "Preventing Disease" section in Community-Acquired Pneumonia for detailed guidance on immunization against pneumococcal disease, as well as the evidence summary.

Summary of Recommendations

For all people with HIV without a history of pneumococcal vaccination or with unknown vaccine history:

- Administer either 20-valent pneumococcal conjugate vaccine (PCV20) or PCV15 **(AII).**
- If PCV15 is used, administer a dose of PPSV23 at least 8 weeks later **(AII).** No additional pneumococcal vaccine doses are recommended.

For people with HIV who previously started or completed a pneumococcal vaccination series, there is no need to restart the series.

- People with HIV who received PCV13 and were 65 years or older when they received a dose of PPSV23 do not require further doses of PPSV23. Shared clinical decision-making is recommended regarding administration of PCV20 for adults aged ≥65 years who completed their vaccine series with both PCV13 and PPSV23. If a decision to administer PCV20 is made, a dose of PCV20 is recommended at least 5 years after the last pneumococcal vaccine dose **(CIII).**
- For people with HIV who received PCV13 and were younger than 65 when they received a dose of PPSV23, one dose of PCV20 administered at least 5 years after may be used to complete their pneumococcal vaccinations **(CIII)** or additional doses of PPSV23 are recommended as indicated below **(BIII).**
    - People with HIV who have received PCV13 and PPSV23 at age <65 should receive a second dose of PPSV23 at least 5 years after the first dose. If they are age 65 or older at the time of their second dose, they do not require additional doses of PPSV23.
    - If they were <65 at the time of the second dose, they should receive a third and final dose at or after age 65, at least 5 years after the second PPSV23 dose.
- People with HIV who have only received PPSV23 may receive a PCV (either PCV20 or PCV15) ≥1 year after their last PPSV23 dose to complete their pneumococcal vaccination series **(BIII).**
- People with HIV who previously received only the PCV13 should receive one dose of PCV20 at least 1 year later OR receive PPSV23 at least 8 weeks later and then complete the PPSV23 series as recommended above **(BIII).**

Tetanus, Diphtheria, and Pertussis Vaccine

Summary of Recommendations

- Administer the combination tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine (Tdap) once if the person with HIV had not been vaccinated at age 11 or older, and then tetanus and diphtheria toxoids vaccine (Td) or Tdap every 10 years thereafter **(AII).**
- For pregnant individuals with HIV, administer one dose of Tdap during each pregnancy, preferably between 27 weeks and 36 weeks gestation **(AIII).**
- For adolescents and adults with HIV who have not received the primary vaccination series for tetanus, diphtheria, or pertussis, administer one dose of Tdap followed by one dose of Td or Tdap at least 4 weeks after Tdap, and another dose of 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 the first dose **(AIII).**

Evidence Summary

Antibody response to tetanus and diphtheria vaccination varies by CD4 count. For individuals with advanced HIV and a low CD4 count, immunologic response is attenuated for both tetanus and diphtheria when compared to HIV-uninfected controls.[66,67] For people with CD4 count >300 cells/mm^3, antibody response to tetanus vaccination is similar to the general population, whereas response to diphtheria remains diminished.[66-68] 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. People 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 Tdap, followed by a Td or Tdap booster every 10 years.

Varicella Vaccine

See "Vaccination to Prevent Primary Infection (Varicella)" in the Varicella-Zoster Virus Disease section for detailed guidance on immunization against varicella, as well as the evidence summary.

Summary of Recommendations

- People with HIV 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 people with HIV who are varicella non-immune with CD4 count ≥200 cells/mm^3, administer two doses of VAR 3 months apart **(BIII).**
- VAR is **contraindicated** for people with HIV with CD4 count <200 cells/mm^3 **(AIII).**

Herpes Zoster Vaccine

See "Vaccination to Prevent Reactivation Disease (Herpes Zoster)" in the Varicella-Zoster Virus Disease section for detailed guidance on immunization against zoster, as well as the evidence summary.

Summary of Recommendations

- For people with HIV ≥18 years, administer two doses of recombinant zoster vaccine (RZV) at 0 and 2 to 6 months **(AIII).**
- Consider delaying vaccination until the patient is virologically suppressed on ART **(CIII)** or until the CD4 count is ≥200 cells/mm^3 to ensure a robust vaccine response **(CIII).**
- People with HIV ≥18 years should receive RZV regardless of previous history of herpes zoster or previous receipt of zoster vaccine live (no longer available).

Recommended Adult Immunization Schedule by Medical Condition and Other Indications

Vaccine Preventable Infection	Indication	Recommendations	Additional Comments	ACIP Recommendations
COVID-19	All people regardless of CD4 count or viral load (AIII)	People with HIV should receive a complete COVID-19 vaccine series regardless of their CD4 count or HIV viral load (AIII). For current COVID-19 vaccination recommendations, please visit CDC.gov.	People with advanced or untreated HIV are considered moderately or severely immunocompromised. Advanced HIV is defined as people with CD4 count <200 cells/mm^3, a history of an AIDS-defining illness without immune reconstitution, or clinical manifestations of symptomatic HIV.	No difference in recommendations
Hepatitis A virus (HAV)	HAV susceptible with HIV infection (AIII)	Two-dose series of either single-antigen vaccine: • Havrix: 1.0 mL IM (0, 6–12 months) (AII); *or* • Vaqta: 1.0 mL IM (0, 6–18 months) (AIII) Alternative for individuals susceptible to both HAV and HBV: • Twinrix: 1.0 mL IM o Three-dose series (0, 1, 6 months) (AII)	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/mm^3 (BIII). For travelers, some clinicians recommend: • Four-dose series (0, 7, 21–30 days, 12 months) of Twinrix (BII)	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 people who are non-immune.		

Recommended Adult Immunization Schedule by Medical Condition and Other Indications

Vaccine Preventable Infection	Indication	Recommendations	Additional Comments	ACIP Recommendations
Hepatitis B virus (HBV)	HBV susceptible and never vaccinated (i.e., anti-HBs <10 mIU/mL)	Patients may receive any of the following single-antigen vaccines: • Engerix-B (40 mcg) or Recombivax (20 mcg): three-dose series (0, 1, 6 months) (AII); *or* • Heplisav: two-dose series (0, 1 month) 20 mcg in 0.5 mL IM (AII) Alternative for individuals susceptible to both HAV and HBV: • Twinrix: 1.0 mL IM: three-dose series (0, 1, 6 months) (AII)	Anti-HBs should be obtained 1 to 2 months after completion of the vaccine series. Vaccinate individuals with isolated anti-HBc with one standard dose of HepB (BII) and check anti-HBs titers 1–2 months afterward. If anti-HBs ≥100 mIU/mL, no further vaccination is needed, but if the titer is <100 mIU/mL, then vaccinate with a complete series of HepB (double dose) followed by anti-HBs testing (BII). If titers are not available, then give a complete vaccine series followed by anti-HBs testing (BII). Safety and efficacy of Heplisav has not yet been studied in people with HIV. If a two-dose vaccine is preferred, Heplisav is an option. If a significant delay occurs between doses, there is no need to restart the series. For travelers, some clinicians recommend: • Four-dose series (0, 7, 21–30 days, 12 months) of Twinrix (BII)	ACIP does not recommend the use of double-dose Engerix-B or Recombivax for people with HIV.
	Vaccine nonresponder (if anti-HBs <10 mIU/mL after three-dose series)	Revaccinate with either: • Second three-dose series of Engerix-B (40 mcg) or Recombivax (20 mcg) (BIII); *or* • Two-dose series of Heplisav-B (BIII) Delay repeat vaccination until after the CD4 count is ≥200 cells/mm^3 (CIII).		
	Post-exposure prophylaxis	For exposed people who have been previously vaccinated with complete series and have documented antibody response, no additional vaccine is needed.		

Vaccine Preventable Infection	Indication	Recommendations	Additional Comments	ACIP Recommendations
		For exposed people who have received complete series without documentation of antibody response, administer a single dose of HepB vaccine. For exposed people who have not received a vaccine or have not received the complete series, administer or complete the HepB vaccine series and administer a dose of 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).	Some experts consider that a four-dose vaccine series of recombinant hepatitis B vaccine (Engerix-B 40 mcg or Recombivax 20 mcg at 0, 1, 2, and 6 months) may produce a better immunologic response, but this approach has not been demonstrated to be superior to a double-dose, three-dose series.	
Human papillomavirus (HPV)	Adults and adolescents through age 26	Recombinant 9-valent human papillomavirus vaccine (Gardasil 9): 0.5 mL IM three-dose series (0, 1–2, and 6 months) (AIII)	If a significant delay occurs between doses, there is no need to restart the series. Routine vaccination is not recommended for people ages 27–45 years (AI). Some people with HIV may benefit from vaccination in this age group, and shared clinical decision-making between the provider and patient is recommended in these situations.	No difference in recommendations
	Adults and adolescents who previously received bivalent or quadrivalent vaccine	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).	Vaccination is not recommended during pregnancy (CIII). Delay until after pregnancy.	

Recommended Adult Immunization Schedule by Medical Condition and Other Indications

Vaccine Preventable Infection	Indication	Recommendations	Additional Comments	ACIP Recommendations
Influenza	All	One dose of age appropriate IIV or RIV annually (AI) LAIV is contraindicated (AIII).	Information on currently available influenza vaccines is available through the CDC recommendation Prevention and Control of Seasonal Influenza with Vaccines. Influenza vaccines are quadrivalent, with formulations that change from season to season. Adults age ≥65 years are recommended to receive high-dose IIV (Fluzone High-Dose) or adjuvanted IIV (FLUAD) over standard-dose unadjuvanted vaccine (AII). People age ≥18 years also may use RIV (Flublok Quadrivalent). For people 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). For pregnant individuals with HIV, administer inactivated influenza or recombinant vaccine at any time during pregnancy (AI).	No difference in recommendations
Measles, mumps, and rubella (MMR)	CD4 count ≥200 cells/mm^3 and no evidence of immunity to measles, mumps, or rubella	Two-dose series of MMR vaccine at least 1 month apart (AIII) MMR is contraindicated if CD4 count <200 cells/mm^3. MMR vaccine is contraindicated during pregnancy.	Evidence of immunity to MMR: • Birth date before 1957, *or* • Documentation of receipt of MMR, *or* • Laboratory evidence of immunity or disease for each pathogen	No difference in recommendations.

Vaccine Preventable Infection	Indication	Recommendations	Additional Comments	ACIP Recommendations
			For pregnant people without immunity to rubella, after pregnancy, administer two doses of MMR vaccine at least 1 month apart if CD4 count ≥200 cells/mm^3 (AIII).	
	Post-exposure prophylaxis	For measles, non-immune individuals with CD4 count >200 cells mm^3, administer MMR vaccine within 72 hours of exposure or IG within 6 days of exposure. Do not administer MMR vaccine and IG simultaneously. For measles, non-immune individuals with CD4 count <200 cells mm^3 or those who are pregnant, administer IG.		
Meningococcus serogroup A, C, W, Y (MenACWY)	Not received any polyvalent meningococcal vaccine	Menveo or MenQuadfi: • Two-dose series given at least 8 weeks apart (AII) • Booster dose of same MenACWY vaccine every 5 years (BIII)	MenACWY vaccine is routinely recommended.	No difference in recommendations
Meningococcus serogroup B	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).	• Two-dose series of Bexsero or three-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

Vaccine Preventable Infection	Indication	Recommendations	Additional Comments	ACIP Recommendations
Mpox	All people who have potential for mpox exposure or anticipate potential exposure to mpox per CDC interim clinical considerations (BII), including those who request vaccination (CII)	Administer two-dose series of JYNNEOS (0.5 mL SQ or 0.1 mL ID) given 28 days apart (AII). Administration of live replicating vaccinia vaccines (i.e., ACAM2000) to people with HIV is contraindicated (AII).	SQ administration is the FDA-approved standard regimen for adults (≥18 years). SQ administration is authorized for people aged <18 years under an Emergency Use Authorization. ID administration is authorized as an alternative regimen for people age ≥18 years under an Emergency Use Authorization. The alternative regimen, when feasible, is preferred when the vaccine supply is scarce. People with a history of developing keloid scars should receive SQ administration. JYNNEOS can be co-administered with most other vaccines. Adolescent and young adult men might consider a 4-week interval between receiving JYNNEOS vaccine and a COVID-19 vaccine because of potential risk for myocarditis and pericarditis. JYNNEOS can be administered to people who are pregnant, breastfeeding, or trying to become pregnant and who require vaccination (BIII).	No difference in recommendations
	Post-exposure prophylaxis	For unvaccinated people with HIV who experience a known or presumed exposure, administer complete series (two doses 0, 4 weeks [28 days]) of JYNNEOS, with the first dose given as soon as possible within 4 to 14 days after exposure to mpox (BII).		

Vaccine Preventable Infection	Indication	Recommendations	Additional Comments	ACIP Recommendations
Pneumococcal	No prior pneumococcal vaccine or vaccination history unknown	Administer either of the following: • PCV20 (Prevnar20): 0.5 mL IM x 1 (AII); *or* • PCV15 (Vaxneuvance): 0.5 mL IM × 1 followed **at least** 8 weeks later by PPSV23 (Pneumovax): 0.5 mL IM × 1 (AII).	While people with HIV with CD4 count <200 cells/mm^3 can be offered PPSV23 at least 8 weeks after receiving PCV15 (CIII) (such as if there are concerns with retention in care), PPSV23 should preferably be deferred until after an individual's CD4 count increases to >200 cells/mm^3 while on ART (BIII).	
	Previously received PCV13 and PPSV23	If <65 years when received dose of PPSV23: • Administer PCV20 0.5 mL IM x 1 at least 5 years after the last pneumococcal vaccine (CIII); *or* • Revaccinate the following with PPSV23 0.5 mL IM x 1 (BIII): o Adults aged 19–64 years if ≥5 years since the first PPSV23 dose o Adults aged ≥65 years if: ▪ Previous PPSV23 administered at age <65, *and* ▪ ≥5 years since the previous PPSV23 dose, *and* ▪ At least 8 weeks after receipt of PCV13	Patients should receive a maximum of three doses of PPSV23. There is no need to give additional doses of PPSV23 every 5 years.	

Vaccine Preventable Infection	Indication	Recommendations	Additional Comments	ACIP Recommendations
		If ≥65 years when received dose of PPSV23: • No further doses of PPSV23 are required. • Shared decision-making is recommended regarding administration of PCV20 for adults aged ≥65 years who have completed both PCV13 and PPSV23. If PCV20 given, administer at least 5 years after last pneumococcal vaccine dose (CIII).		
	Previously received only PCV13	Administer PCV20 0.5 mL IM x 1 at least 1 year after PCV13 (BIII); *or* Administer initial dose of PPSV23 0.5 mL IM × 1 at least 8 weeks after PCV13 (AII). Revaccinate the following with PPSV23 0.5 mL IM x 1 (BIII): • Adults aged 19–64 years if ≥5 years since the first PPSV23 dose • Adults aged ≥65 years if ≥5 years since the previous PPSV23 dose	In patients who received PCV13 when their CD4 count was <200 cells/mm^3 and PPSV23 will be given, some experts may choose to defer PPSV23 until CD4 count is >200 cells/mm^3 to optimize vaccine efficacy (CIII).	
	Previously received only PPSV23	Administer either of the following at least 1 year after last PPSV23 dose: • PCV20: 0.5 mL IM x 1 (BIII); *or* • PCV15: 0.5 mL IM × 1 (BIII)	When PCV15 or PCV20 is used in those with history of PPSV23 receipt, it need not be followed by another dose of PPSV23.	

Recommended Adult Immunization Schedule by Medical Condition and Other Indications

Vaccine Preventable Infection	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 IPV (CIII).	Three doses IPV IM at 0, 1–2 months, and third dose given 6–12 months after second dose (CIII)		
	Previously vaccinated with one to two doses of vaccine	Give remaining doses of vaccine at recommended intervals (CIII).		
Tetanus, diphtheria, and pertussis	Did not receive Tdap at age 11 years or older	One 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 (AIII). One 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	Two-dose series of VAR 3 months apart (BIII) VAR **is contraindicated** if CD4 count <200 cells/mm^3 (AIII).	Evidence of immunity to varicella: • Documented receipt of two 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

Recommended Adult Immunization Schedule by Medical Condition and Other Indications

Vaccine Preventable Infection	Indication	Recommendations	Additional Comments	ACIP Recommendations
Zoster	Age ≥18 years, regardless of past episode of herpes zoster or receipt of attenuated ZVL (Zostavax) and regardless of CD4 count	Give two-dose series of 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 (Shingrix) during an acute episode of herpes zoster (AIII).	ACIP recommends RZV for adults ≥19 years who are or will be at risk for herpes zoster. (This difference in age selected by ACIP was made to align with the age range in the adult immunization schedule.)

Recommended Adult Immunization Schedule by Medical Condition and Other Indications

Vaccine Preventable Infection	Indication	Recommendations	Additional Comments	ACIP Recommendations
Immunizations for Travel				
Cholera	Not routinely recommended for most travelers (CIII). Age 18–64 years old with CD4 count >200 cells/mm^3 traveling to an area where cholera is epidemic or endemic within the past year	Lyophilized CVD 103-HgR (Vaxchora) single oral dose at least 10 days prior to potential exposure (CIII)	Safety and efficacy have not been established in individuals with HIV. No adverse effects reported with older formulation of vaccine in individuals with HIV infection without an AIDS diagnosis.	No current recommendations for individuals with HIV infection
Typhoid	At risk of *Salmonella* serotype typhi infection (travel, intimate exposure to a chronic carrier, occupational exposure) Revaccination only if continued or renewed exposure to *Salmonella* serotype typhi is expected.	One dose Vi capsular polysaccharide vaccine (Typhim Vi) via intramuscular injection at least 1 week before exposure (AIII) Revaccinate every 2 years if risk remains (BIII). The live attenuated oral typhoid vaccine (Vivotif) is contraindicated in people with HIV (AIII).	Provide education on other preventive measures against foodborne illness in addition to typhoid vaccination (AIII). Safety of typhoid vaccination in pregnancy is unknown. Consider avoiding during pregnancy (AIII).	ACIP has no position on the use of typhoid vaccine in people with HIV except not to give immunocompromised people the live attenuated vaccine.
Yellow fever (YF)	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)	If indicated, provide vaccination at least 10 days prior to expected exposure. Age <59 years and asymptomatic with CD4 count >500 cells/mm^3: One dose of YF vaccine, revaccinate in >10 years if risk remains (BIII).	Provide vaccination as an adjunct to other protective measures against mosquito bites. Pregnancy and age ≥60 years may increase risk of complications from YF vaccine administration.	No difference in recommendations

		Any age and asymptomatic with CD4 count 200–499 cells/mm^3: YF vaccine may be considered depending on risk (BIII). YF vaccine **is contraindicated** for people with CD4 count <200 cells/mm^3. This recommendation is based on a theoretic increased risk for encephalitis in this population (AII).	If international travel requirements rather than an increased risk for acquiring YF infection are the only reason to vaccinate people with HIV, excuse the person from vaccination and issue a medical waiver to fulfill health regulations. Closely monitor people with HIV who have received YF vaccine for evidence of adverse events.	

Key: ACIP = Advisory Committee on Immunization Practices; anti-HBc = hepatitis B core antibody; anti-HBs = hepatitis B surface antibody; ART = antiretroviral therapy; CD4 = CD4 T lymphocyte; CDC = Centers for Disease Control and Prevention; FDA = U.S. Food and Drug Administration; HAV = hepatitis A virus; HBIG = hepatitis B immune globulin; HBV = hepatitis B virus; HepA = hepatitis A vaccine; HepB = hepatitis B vaccine; HPV = human papillomavirus; IG = immunoglobulin; IgG = immunoglobulin G; IIV = inactivated influenza vaccine; IM = intramuscular; IPV = inactivated polio vaccine; LAIV = live attenuated influenza vaccine; MenACWY = meningococcus serogroup A, C, W, Y; MenB = serogroup B meningococcal vaccination; MMR = measles, mumps, and rubella; MMRV = measles, mumps, rubella, and varicella; PCV13 = 13-valent pneumococcal conjugate vaccine; PCV15 = 15-valent pneumococcal conjugate vaccine; PPSV23 = 23-valent pneumococcal polysaccharide vaccine; PVC13 = 13-valent pneumococcal conjugate vaccine; RIV = recombinant influenza vaccine; RZV = recombinant zoster vaccine; SQ = subcutaneous; Td = tetanus and diphtheria toxoids vaccine; Tdap = combination tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine; VAR = varicella vaccine; YF = yellow fever; ZVL = zoster vaccine live

Note: Recommendations may differ from the ACIP.

Recommended Immunization Schedule for Adults and Adolescents with HIV

Vaccine	All People with HIV	Where Varies by Age	Where Varies by CD4 Cell Count (cells/mm^3)	
			<200	**≥200**
Hepatitis A	Two to three doses (varies by formulation)			
Hepatitis B	Two to four doses (varies by formulation and indication)			
Human papillomavirus (HPV)		Three doses for ages 18–26*		
Influenza	One dose annually			
Measles, mumps, rubella (MMR)			Contraindicated	Two doses if born after 1956 with no history of vaccination or positive antibody titer
Meningococcal A,C,W,Y conjugate (MenACWY)	Two doses, booster every 5 years			
Meningococcal B (MenB)	Two to three doses (varies by formulation)			
Mpox (MVA-BN, attenuated)	Two doses			
Mpox (ACAM2000, live replicating)	Contraindicated			
Pneumococcal conjugate (PCV15 or PCV20)	One dose			
Pneumococcal polysaccharide (PPSV23)	One dose (if conjugate vaccine was PCV-15)			
COVID-19	For current COVID-19 vaccination recommendations, please visit CDC.gov.		Recommendations differ with advanced or untreated HIV infection	
Tetanus, diphtheria, pertussis (Tdap/Td)	Tdap once, then Td or Tdap booster every 10 years			
Varicella (VAR)			Contraindicated	Two doses
Zoster recombinant (RZV)		Two doses for ages 18 and older		

Recommended for all adults and adolescents with HIV who meet the age requirement or lack documentation of vaccination or evidence of past infection.

Recommended for adults and adolescents with HIV with another risk factor (medical, occupational, or other indication) or in select circumstances.

Contraindicated

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