HIV Preexposure Prophylaxis (PrEP)

This is a PDF version of the following document:
Module 5: Prevention of HIV
Lesson 5: HIV Preexposure Prophylaxis (PrEP)

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Background

Despite decades of efforts to implement HIV-related risk-reduction programs in the United States, the number of new HIV infections has remained greater than 30,000 new infections per year.[1] It is clear that additional efforts are needed to reduce the number of new HIV infections in the United States. An expanding number of HIV prevention methods are being implemented worldwide, and HIV preexposure prophylaxis (PrEP) is now accepted as an important and highly impactful prevention strategy.[2,3] Most often, HIV PrEP is used to prevent sexual transmission of HIV, but it has also been used to prevent transmission of HIV associated with injection drug use. There are now three types of HIV PrEP that are used in the United States: (1) daily oral HIV PrEP with either oral tenofovir DF-emtricitabine or oral tenofovir alafenamide-emtricitabine, (2) on-demand (2-1-1) dosing using oral tenofovir DF-emtricitabine, and (3) long-acting injectable HIV PrEP (using intramuscular cabotegravir [cabotegravir-IM] or subcutaneous lenacapavir [lenacapavir-SQ]) (Figure 1).[4,5]

Guidelines for HIV PrEP

- **Centers for Disease Control and Prevention (CDC)**: In December 2021, the Centers for Disease Control and Prevention (CDC) and the U.S. Public Health Service (USPHS) published an updated 2021 CDC PrEP Clinical Practice Guideline along with an updated Clinical Providers' Supplement.[4,6] In 2025, the CDC provided guidance for the use of lenacapavir for HIV PrEP.[5]
- **International Antiviral Society-USA (IAS-USA)**: In December 2022, the International Antiviral Society-USA Panel (IAS-USA) updated the Antiretroviral Drugs for Treatment and Prevention of HIV Infection in Adults guidelines, which include recommendations for prescribing oral and injectable HIV PrEP.[7] The IAS-USA issued a brief update in 2025 that focused on use of lenacapavir-SQ for HIV PrEP.
- **United States Preventive Services Task Force (USPSTF)**: In August 2023, the United States Preventive Services Task Force (USPSTF) gave a Grade A recommendation for the use of HIV PrEP by clinicians to reduce HIV acquisition in persons at risk of acquiring HIV.[8,9]

Persons to Consider for HIV PrEP

In the United States, it is estimated that approximately 1.2 million persons have an HIV PrEP indication.[4,10] Although use of HIV PrEP has increased in the United States in recent years, data from 2022 indicate that only 26% of individuals in the United States with an HIV PrEP indication were prescribed HIV PrEP (Figure 2).[11,12] In addition, significant differences in access to and receipt of HIV PrEP persist based on socioeconomic and demographic factors, such as region of residence, sex, age, race, ethnicity, insurance status, residing in a state with expanded Medicaid or an HIV PrEP drug assistance program, as well as other factors.

Screening for HIV PrEP

Health care professionals should provide all sexually active adult and adolescent persons with information regarding HIV PrEP.[4] A brief sexual history is recommended to assess the risk of acquiring HIV and potential indications for HIV PrEP. The specific indications for HIV PrEP, as recommended in the 2021 CDC PrEP Clinical Practice Guideline, are outlined as follows:

Sexually Active Adults and Adolescents who Weigh at Least 35 kg

Anal or vaginal sex in past 6 months AND any of the following:

- Sex partner with HIV (especially if the person with HIV has an unknown or detectable viral load)
- Bacterial sexually transmitted infection within the past 6 months (gonorrhea, chlamydia, and syphilis for men who have sex with men, including those who inject drugs; gonorrhea and syphilis for heterosexual women and men, including persons who inject drugs)
- History of inconsistent or no condom use with sexual partner(s)

Persons who Inject Drugs

Persons who inject drugs should also be assessed for all the following and for their sexual risk of HIV.

- Injecting partner who has HIV
- Sharing injection equipment
- Have sexual risk for acquiring HIV

Recommended Regimens and Dosing for HIV PrEP

Currently, in the United States, there are four medications that have received FDA approval for HIV PrEP: oral tenofovir DF-emtricitabine, oral tenofovir alafenamide-emtricitabine, long-acting injectable cabotegravir, and long-acting injectable lenacapavir.[13,14]

Tenofovir DF-emtricitabine (Oral)

- **Approved Indication for HIV PrEP**: Tenofovir DF-emtricitabine is indicated for HIV PrEP to reduce the risk of sexually-acquired HIV in adults and adolescents (weighing at least 35 kg).
- **Formulation/Dosing**: Tenofovir DF-emtricitabine is a fixed-dose combination that contains 300 mg of tenofovir DF and 200 mg of emtricitabine. The recommended dosing of tenofovir DF-emtricitabine when used for HIV PrEP is one tablet once daily, with or without food. Alternative dosing, such as on-demand (2-1-1) dosing, is not included in the FDA indication but can be considered “off-label” for select men who have sex with men.
- **Use in Persons with Renal Impairment**: Tenofovir DF-emtricitabine is not recommended for HIV PrEP in persons who have an estimated creatinine clearance of less than 60 mL/min.

Tenofovir alafenamide-emtricitabine (Oral)

- **Approved Indication for HIV PrEP**: Tenofovir alafenamide-emtricitabine is indicated for HIV PrEP in adults and adolescents (weighing at least 35 kg) who are at risk of acquiring HIV sexually, excluding women at risk from receptive vaginal sex.[15] Tenofovir alafenamide-emtricitabine is not indicated for receptive vaginal sex because its effectiveness in this population has not been established, although it is currently under investigation.
- **Formulation/Dosing**: Tenofovir alafenamide-emtricitabine is a two-drug, fixed-dose combination that contains 25 mg of tenofovir alafenamide and 200 mg of emtricitabine. Oral tenofovir alafenamide-emtricitabine should be taken as one tablet once daily, with or without food. Alternative dosing, such as on-demand (2-1-1) dosing, is not recommended.
- **Use in Persons with Renal Impairment**: For HIV PrEP, tenofovir alafenamide-emtricitabine is not recommended for persons who have an estimated creatinine clearance of less than 30 mL/min, unless they are on dialysis.

Cabotegravir-IM (Long-Acting Injectable)

- **FDA-Approved Indication for HIV PrEP**: Long-acting injectable cabotegravir, administered as an intramuscular dose (cabotegravir-IM), is indicated as HIV PrEP for adults and adolescents (weighing at least 35 kg) who are at risk of sexual acquisition of HIV. Cabotegravir-IM has not been studied as a prevention measure for people who are at risk of acquiring HIV from injecting drugs.
- **Formulations/Dosing**: Cabotegravir-IM is available as a 200 mg/mL solution and is administered as a 3 mL intramuscular injection in the gluteal region. Oral cabotegravir is a 30 mg tablet that is taken once daily, with or without food. Cabotegravir-IM is administered as a 600 mg (3 mL) injection, which is repeated 1 month after the first injection, and then repeated every 2 months thereafter. An optional lead-in with oral cabotegravir 30 mg once daily may be used for approximately 1 month to assess the tolerability of cabotegravir. If the oral cabotegravir lead-in is used, the first injection of cabotegravir-IM should be given on the last day of the oral lead-in (or within 3 days of completing the oral lead-in).
- **Use in Persons with Renal Impairment**: For HIV PrEP, cabotegravir has no renal restrictions. For persons who have a creatinine clearance less than 30 mL/min, increased monitoring for cabotegravir toxicity is recommended. Hemodialysis is not expected to impact cabotegravir levels.

Lenacapavir-SQ (Long-Acting Injectable)

- **FDA-Approved Indication for HIV PrEP**: Long-acting injectable lenacapavir, administered as a

subcutaneous dose (lenacapavir-SQ), is indicated for HIV PrEP to reduce the risk of sexually-acquired HIV-1 for adults and adolescents who weigh at least 35 kg (77 lbs). There are two lenacapavir-SQ medications available for commercial use—lenacapavir-SQ (*Yeztugo*) for HIV PrEP and lenacapavir-SQ (*Sunlenca*) for HIV treatment. Although these two lenacapavir-SQ medications contain the same recommended dose and dosing frequency, it is important to designate the correct brand, based on whether HIV PrEP is the indication or HIV treatment. In addition, there are two different oral brand preparations: oral lenacapavir (*Yeztugo*) for HIV PrEP and oral lenacapavir (*Sunlenca*) for HIV treatment.

- **Formulations/Dosing**: Lenacapavir-SQ is available in 1.5 mL vials that contain 463.5 mg of lenacapavir. Lenacapavir is also available as a 300 mg tablet that can be taken with or without food. Use of lenacapavir-SQ for HIV PrEP requires a 2-day initiation phase that uses both oral and injection doses. Day 1 of the initiation phase requires a 600 mg (2 x 300 mg tablets) dose of oral lenacapavir and a 927 mg (2 x 463.5 mg injections) of lenacapavir-SQ. Day 2 of the initiation phase requires a 600 mg (2 x 300 mg tablets) dose of oral lenacapavir. After the 2-day initiation phase, lenacapavir-SQ 927 mg (2 x 463.5 mg injections) is administered every 26 weeks.
- **Use in Persons with Renal Impairment**: There are no dosage adjustments of lenacapavir-SQ or oral lenacapavir in persons with mild, moderate, or severe renal insufficiency. There are insufficient data on the use of lenacapavir-SQ or oral lenacapavir in persons who have a creatinine clearance less than 15 mL/min. In addition, there are insufficient data on the use of lenacapavir-SQ or oral lenacapavir in persons receiving hemodialysis, but lenacapavir is highly protein bound and thus hemodialysis is not likely to significantly impact lenacapavir levels.

On-Demand (2-1-1) with Tenofovir DF-Emtricitabine

Although on-demand dosing is not FDA-approved for HIV PrEP in the United States, the 2021 CDC PrEP Clinical Practice Guideline recommends that on-demand (2-1-1) HIV PrEP with oral tenofovir DF-emtricitabine can be considered in selected adult men who have sex with men.[4] Any person who starts on-demand HIV PrEP can change to daily oral HIV PrEP or to an injectable HIV PrEP medication. Dosing with on-demand HIV PrEP consists of taking 2 pills of tenofovir DF-emtricitabine 2 to 24 hours prior to sex, then 1 pill 24 hours after the initial 2 pills, and then 1 pill 48 hours after the initial 2 pills. If sexual activity continues on consecutive days, then 1 pill a day should continue to be taken for 48 hours after the last sexual event.[4] On-demand HIV PrEP should not be used for persons with chronic hepatitis B infection.

Additional Considerations

- **HIV PrEP for Persons who Inject Drugs**: Although no medication has an FDA indication for preventing HIV acquisition through injection drug use, the Bangkok Tenofovir Study showed that persons who inject drugs and take daily tenofovir DF for HIV PrEP experienced a significant reduction in new HIV infections compared with persons taking placebo, with this benefit of PrEP occurring for both men and women.[16] Accordingly, individuals who inject drugs, especially if they do not use clean needles or if they share any injection equipment, should be considered for PrEP with daily tenofovir DF-emtricitabine or injectable lenacapavir to prevent the acquisition of HIV.[4,5] In addition, persons who inject drugs may also have a risk of sexual acquisition of HIV and, therefore, may have an indication for HIV PrEP separate from injection drug use.[4]
- **Women in Periconception, Antepartum, and Postpartum Periods**: Women are at increased risk of HIV acquisition during the periconception period due to multiple factors.[17,18,19] There are substantial data in women demonstrating the safety of tenofovir DF-emtricitabine for HIV PrEP and for treatment of HIV during the periconception, antepartum, and postpartum periods.[20,21,22] If HIV PrEP is indicated during pregnancy, the preferred option is daily oral tenofovir DF-emtricitabine.[23] If an option other than tenofovir DF-emtricitabine is needed, expert consultation should be obtained.

Baseline Evaluation, Immunizations, and Counseling

Baseline Laboratory Studies

The following are recommended as baseline studies for persons initiating HIV PrEP.[4,5]

- **HIV Testing**: All persons starting HIV PrEP require baseline HIV testing, which should and the testing should occur within 7 days prior to starting HIV PrEP. For persons starting oral HIV PrEP, baseline HIV testing should ideally include a laboratory blood-based HIV antigen-antibody test. Alternatively, a point-of-care blood-based HIV antigen-antibody fingerstick blood test can be performed for the initial HIV screening test, with confirmation of negative results using a laboratory blood-based HIV antigen-antibody test. For persons starting cabotegravir-IM, HIV testing should also include an HIV RNA test prior to the first injection (and prior to starting oral cabotegravir if oral lead-in dosing is used). For person starting lenacapavir-SQ, a baseline HIV RNA test should also be ordered, but the results can be pending when starting lenacapavir. Confirming a negative baseline HIV test prior to starting HIV PrEP is extremely important—if a person had undiagnosed HIV and started on an HIV PrEP regimen, it would provide inadequate HIV treatment and likely result in the development of significant HIV drug resistance.
- **Renal Function**: For persons planning to receive either tenofovir DF-emtricitabine or tenofovir alafenamide-emtricitabine, a baseline serum creatinine should be ordered to evaluate renal function, including a confirmed calculated creatinine clearance using the Cockcroft-Gault formula. Persons with an estimated creatinine clearance less than 60 mL/min should not receive tenofovir DF-emtricitabine for HIV PrEP. Individuals with estimated creatinine clearance less than 30 mL/min should not receive tenofovir alafenamide-emtricitabine for HIV PrEP. Baseline laboratory studies to evaluate renal function are not required for persons starting on cabotegravir or lenacapavir.
- **Sexually Transmitted Infections**: Baseline testing for sexually transmitted infections should include testing for gonorrhea, chlamydia, and syphilis. Serologic testing for syphilis requires a blood draw. Testing for gonorrhea and chlamydia should utilize nucleic acid testing (NAT) and samples should be obtained from anatomic sites of sexual exposure.
- **Lipid Panel**: Persons who receive tenofovir alafenamide-emtricitabine should have a baseline lipid panel as tenofovir alafenamide-emtricitabine can cause minor alterations in serum lipids, including elevated triglyceride levels. When tenofovir alafenamide-emtricitabine and tenofovir DF-emtricitabine are compared, lipid parameters are higher with the tenofovir alafenamide option, though whether this is clinically significant remains controversial.
- **Hepatitis B**: For all persons with unknown hepatitis B status, baseline serologic screening should include hepatitis B surface antigen (HBsAg), antibody to hepatitis B core (anti-HBc), and antibody to hepatitis B surface antigen (anti-HBsAg).[24] Persons nonimmune to hepatitis B should be offered immunization for hepatitis B. Persons who have a positive HBsAg test should have further evaluation for the management of hepatitis B. Testing for hepatitis B is particularly important if starting tenofovir DF-emtricitabine or tenofovir alafenamide-emtricitabine since these medications also treat HBV; an individual with active hepatitis B infection could develop a hepatitis flare following discontinuation of these HIV PrEP medications.[25] Hepatitis B screening is recommended even if starting a medication such as cabotegravir-IM or lenacapavir-SQ, since results can inform the need for vaccination or potential hepatitis B treatment.
- **Hepatitis C**: For persons who are starting HIV PrEP, baseline screening for hepatitis C virus (HCV) infection should be performed for all men who have sex with men and people who inject drugs. Testing for HCV infection should consist of an initial HCV antibody test, followed by HCV RNA testing for all positive HCV antibody tests. For persons who have never tested for HCV, one-time HCV testing is recommended for all adults in the United States who are 18 years of age and older.[26]
- **Pregnancy Testing**: For women of childbearing age who are starting HIV PrEP, a baseline pregnancy test should be performed.

Immunizations

The evaluation and management of persons receiving HIV PrEP also provides an opportunity to counsel and administer vaccines for pathogens that may be transmitted through sex or injection drug use.

- **Hepatitis B Vaccine**: Screening for hepatitis B in persons initiating HIV PrEP will identify some persons who are nonimmune to hepatitis B; these individuals should receive a complete hepatitis B vaccine series.[27]
- **Hepatitis A Vaccine**: In addition, hepatitis A immunization is recommended for certain populations that may overlap with persons seeking HIV PrEP, including men who have sex with men and persons who inject drugs.[28]
- **HPV Vaccine**: Individuals who have not received the human papillomavirus (HPV) vaccine and are candidates (based on their age) for this vaccine should receive immunization with the 9-valent HPV vaccine.[27,29]
- **Mpox Vaccine**: Individuals with an elevated risk for HIV acquisition might also have an increased risk of acquiring mpox virus and thus would also benefit from vaccination with the mpox vaccine.[30]

Behavioral Risk-Reduction Counseling

Because high medication adherence is critical to HIV PrEP efficacy, but is often not achieved, individuals at risk of acquiring HIV should be encouraged and enabled to use HIV PrEP in combination with other effective HIV prevention methods.[6] When HIV PrEP is prescribed, clinicians should provide access, directly or by facilitated referral, to proven effective risk-reduction and support services.[6] In addition, it is important to counsel persons who take HIV PrEP that HIV PrEP medications do not prevent acquisition of bacterial sexually transmitted infections or infections, such as hepatitis C virus, which can be acquired sexually or from sharing injecting needles or other injecting equipment.

Major HIV PrEP Studies

There have been multiple large, randomized, controlled trials investigating the efficacy of HIV PrEP in groups with different risk factors, as summarized below.

Men Who have Sex with men

- **DISCOVER**: This phase 3, randomized, double-blind trial compared the safety and efficacy of daily oral tenofovir alafenamide-emtricitabine with daily oral tenofovir DF-emtricitabine for HIV PrEP in adult men who have anal sex with other men.[31] The study enrolled a total of 5,387 persons in the United States and Canada.[31] Primary efficacy analysis at week 48 (for all participants) and week 96 (for half of participants) indicated the incidence of documented new HIV infections with daily tenofovir alafenamide-emtricitabine (0.16 per 100 person-years) was noninferior to daily tenofovir DF-emtricitabine (0.34 per 100 person-years) at preventing HIV acquisition.[31]
- **HPTN 083**: The HPTN 083 study was a randomized, double-blind, double-dummy, noninferiority trial to compare long-acting injectable cabotegravir with daily oral tenofovir DF–emtricitabine for the prevention of HIV infection in adults at risk of acquiring HIV (mostly men who have sex with men).[13] There were 39 new HIV infections (incidence 1.22 per 100 person-years) in the tenofovir DF-emtricitabine group and 13 infections (incidence 0.41 per 100 person-years) in the cabotegravir arm.[13]
- **IPreX**; The HIV Iniciativa Profilaxis Pre-Exposición (iPrEx) study was a phase 3, randomized, double-blind, placebo-controlled trial conducted in Peru, Ecuador, Brazil, Thailand, South Africa, and the United States that enrolled 2,499 HIV-seronegative adult men who have anal sex with men.[32] Participants were randomly assigned to receive a daily oral dose of tenofovir DF-emtricitabine or placebo. This study documented 44% fewer new HIV infections among those who received daily tenofovir DF-emtricitabine for HIV PrEP when compared to those who received placebo.[32] The reduction in new HIV infections was much higher (92%) when limiting the analysis to participants with detectable levels of study drug (indicating adherence to the medication).[32]
- **IPERGAY**: The ANRS Intervention Préventive de l'Exposition aux Risques avec et pour les Gays (IPERGAY) study was a phase 3, randomized, double-blind, placebo-controlled trial in France and Canada evaluating the efficacy of oral tenofovir DF-emtricitabine taken before and after sexual activity (referred to as intermittent, on-demand, or 2-1-1 dosing) for the prevention of HIV among 400 sexually active adult men who have anal sex with other men.[33] After a median follow-up of 9.3 months, the relative risk reduction in HIV infection was 86% in persons taking on-demand tenofovir DF-emtricitabine arm.[33]
- **PROUD:** The Preexposure Option for Reducing HIV in the UK (PROUD) study was a phase 4, randomized, open-label study at 13 clinics in England that evaluated the efficacy of daily oral tenofovir DF-emtricitabine for the prevention of HIV among sexually active men without HIV.[34] The 544 study participants were randomized to receive daily tenofovir DF-emtricitabine either immediately upon enrollment or after a deferral period of 1 year. The relative risk reduction in HIV infection in the immediate arm (participants who took tenofovir DF-emtricitabine daily) was 86%.[34]
- **PURPOSE 2**: In the PURPOSE 2 study, lenacapavir-SQ administered every 6 months was compared with daily oral tenofovir DF-emtricitabine in populations that predominantly consisted of men who have sex with men. Among the 2,179 participants in the lenacapavir-SQ study group, there were 2 new HIV infections, which corresponded with a 96% reduction in HIV incidence compared with the expected background HIV incidence.[35] In addition, the HIV incidence was 89% lower with lenacapavir-SQ than with oral tenofovir DF-emtricitabine.[35]

Heterosexual Men and Women

- **Partners PrEP**:The Partners PrEP trial was a phase 3, randomized, double-blind, placebo-controlled study that enrolled 4,758 HIV-serodifferent heterosexual couples in Uganda and Kenya to receive daily oral tenofovir DF, daily oral tenofovir DF-emtricitabine, or daily oral placebo for the prevention of HIV

acquisition.[36] The partners with HIV were not receiving antiretroviral therapy (because they were not eligible per local treatment guidelines that existed at the time the study was conducted).[36] The trial was stopped after an interim analysis showed statistically significant lower HIV transmission rates in both the tenofovir DF group (67% reduction) and tenofovir DF-emtricitabine (75% reduction) group, when compared with the placebo group.[36]

- **TDF2**: The Botswana TDF2 Trial, a phase 3, randomized, double-blind, placebo-controlled study of the safety and efficacy of daily oral tenofovir DF-emtricitabine, enrolled 1,219 heterosexual men and women in Botswana who had tested negative for HIV.[22] In this study, daily oral use of tenofovir DF-emtricitabine resulted in a 62% reduction in HIV acquisition when compared with placebo.[22]

Women

- **FEM-PEP**: The FEM-PrEP trial was a phase 3, randomized, double-blind, placebo-controlled study of the HIV prevention efficacy and clinical safety of daily oral tenofovir DF-emtricitabine among heterosexual women in South Africa, Kenya, and Tanzania.[37] The trial was stopped when an interim analysis determined that the trial would be unlikely to detect a statistically significant difference in efficacy between the two study groups.[37] Adherence was low in this trial, with detectable plasma drug levels in less than 50% of the women assigned to tenofovir DF-emtricitabine.[37]
- **HPTN 084**: The HPTN 084 study was a phase IIb/3, randomized, double-blind trial to compare long-acting injectable cabotegravir-IM with daily oral tenofovir DF–emtricitabine for the prevention of HIV acquisition in women.[14] There were 34 new HIV infections (incidence 1.79 per 100 person-years) in the tenofovir DF-emtricitabine group and 4 infections (incidence 0.21 per 100 person-years) in the cabotegravir-IM arm. Long-acting injectable cabotegravir-IM demonstrated superior efficacy, as compared with tenofovir DF-emtricitabine for the prevention of HIV in women.[14]
- **PURPOSE 1**: In the PURPOSE 1 trial, long-acting injectable subcutaneous lenacapavir (lenacapavir-SQ), administered every 6 months, was compared with oral tenofovir DF-emtricitabine and oral tenofovir alafenamide-emtricitabine.[38] Lenacapavir-SQ was 100% effective in preventing HIV acquisition among African women (0 new HIV infections); the incidence of HIV among participants who took lenacapavir-SQ was significantly lower than background HIV incidence and lower than seen with participants in the other study arms (oral tenofovir-DF-emtricitabine and oral tenofovir alafenamide-emtricitabine).[38]
- **VOICE**: The Vaginal and Oral Interventions to Control the Epidemic (VOICE) study was a randomized, placebo-controlled trial that enrolled women of reproductive age and randomized them to one of three HIV preventative medications (oral tenofovir DF-emtricitabine daily, oral tenofovir DF daily, or a 1% tenofovir vaginal gel) versus placebo.[39] A total 5,029 participants were enrolled at 15 sites in South Africa, Uganda, and Zimbabwe.[39] None of the study arms were found to be effective at reducing the likelihood of HIV transmission as compared to placebo, but adherence to the study drugs was documented to be low.[39]

People who Inject Drugs (PWID)

- **Bangkok Tenofovir Study (BTS)**: The Bangkok Tenofovir Study (BTS) was a phase 2/3, CDC-sponsored, double-blind, placebo-controlled trial that randomized 2,713 persons without HIV who inject drugs to receive either daily oral tenofovir DF or placebo.[16] All participants also received access to addiction support services, methadone programs, bleach for cleaning needles, condoms, and primary care medical services.[16] After a median follow-up time of 4.6 years, the relative risk reduction in HIV was 49% among study participants in the tenofovir DF arm; the relative risk reduction was 70% in a subgroup analysis of individuals with detectable plasma tenofovir levels.[16]

Time to Achieve Protection after Initiating HIV PrEP

After initiating oral HIV PrEP with tenofovir DF-emtricitabine or tenofovir alafenamide-emtricitabine, these medications must reach the body tissues and then undergo phosphorylation to function as inhibitors of HIV replication. There is no consensus as to the required time to reach protective levels (as opposed to maximum levels).

- Available data in humans suggest that with oral ingestion of tenofovir DF, the maximal concentrations of tenofovir diphosphate (the active form of tenofovir) are obtained in peripheral blood mononuclear cells in about 7 days, rectal tissues at about 7 days, and cervicovaginal tissues at about 20 days.[40,41,42] The 2021 CDC PrEP Clinical Practice Guideline does not provide a specific recommendation for the time needed for tenofovir DF-emtricitabine to reach adequate tissue levels to achieve protection from HIV infection.[43] The IAS-USA HIV 2022 Guidelines suggest using a 7-day lead-in time with daily dosing of tenofovir DF-emtricitabine for rectal, penile, and vaginal exposures to ensure adequate tissue levels are achieved, and these guidelines comment that for men starting with a double-dose of tenofovir DF-emtricitabine on the first day likely leads to protective levels by 24 hours (extrapolating data from the 2-1-1 studies).[7]
- There are inadequate data for time to protection after starting tenofovir alafenamide-emtricitabine. Most experts use similar guidance with tenofovir alafenamide-emtricitabine as with tenofovir DF-emtricitabine.
- There are no guidelines regarding how long it would take to achieve protection against HIV acquisition after initiating cabotegravir-IM for HIV PrEP. The IAS-USA HIV 2022 Guidelines comment that onset of HIV protection is likely to be approximately 7 days after the first cabotegravir injection, but further research is needed to confirm this estimate.[7]
- The time to protection after initiating lenacapavir is not known, but limited pharmacokinetic unpublished data from a phase 1 trial in 14 healthy adults suggest protection is likely 2 hours after taking the second oral loading dose of lenacapavir (on day 2).[44]

Impact of Adherence on Efficacy of HIV PrEP

In the HIV PrEP trials completed to date, adherence to HIV PrEP has been the single most important factor that impacts efficacy.[2,45,46] The correlation of adherence with oral HIV PrEP efficacy has been strongest when adherence estimates are based on detection of tenofovir in blood samples (Figure 3).[47] For example, in the iPrEx trial, investigators measured intracellular levels of tenofovir diphosphate and emtricitabine triphosphate and found substantially higher intracellular drug levels in participants who did not acquire HIV than in those subjects who acquired HIV during the study.[32] Consistent with these findings, poor adherence correlated with a lack of HIV PrEP benefit in the FEM-PrEP and VOICE trials.[37,45] Available data for daily oral HIV PrEP (for men and women) suggest that HIV prevention efficacy is greater than 90% if at least 4 doses per week are taken.[48,49,50] If taking an oral pill regularly will be challenging for an individual, long-acting injectable HIV PrEP medications may increase the likelihood of successful adherence. The injections should be administered by a healthcare professional, and are typically done in a clinic.

Laboratory Monitoring on HIV PrEP

All individuals taking HIV PrEP should have laboratory monitoring as part of their routine follow-up evaluations, but the specific follow-up differs depending on whether the person is taking tenofovir DF-emtricitabine, tenofovir alafenamide-emtricitabine, cabotegravir-IM, or lenacapavir-SQ.[4] These follow-up evaluations should take place every 3 months for persons taking oral PrEP (tenofovir DF-emtricitabine or tenofovir alafenamide-emtricitabine) and every 2 months for those taking injectable cabotegravir. The 2021 CDC PrEP Clinical Practice Guideline recommends the following regarding laboratory monitoring for persons taking oral HIV PrEP or cabotegravir-IM.[4] The 2025 CDC recommendations for lenacapavir-SQ as HIV PrEP included guidance for laboratory monitoring.[5] Below is a summary of the CDC recommendations for monitoring for individuals receiving HIV PrEP medications.[4,5]

- **HIV Testing Frequency**: Repeat HIV testing should be performed at least every 3 months for those persons taking oral PrEP (tenofovir DF-emtricitabine or tenofovir alafenamide), at least every 4 months for receiving cabotegravir-IM, and at least every 6 months for persons receiving lenacapavir-SQ. In addition, persons receiving cabotegravir-IM should have HIV testing performed 1 month after the first injection. At any time, if a person receiving HIV PrEP reports clinical manifestations consistent with acute HIV, they should have immediate laboratory evaluation for acute HIV.
- **HIV Testing Method**: In general, the recommended HIV testing for persons receiving oral HIV PrEP or cabotegravir-IM should ideally include both an HIV antigen-antibody test and an HIV-1 RNA assay. The rationale for including HIV-1 RNA in routine testing is that studies have shown a less than optimal performance with standard HIV antigen-antibody testing early in persons who acquire HIV while taking HIV PrEP medications. That said, if cost or coverage issues prevent the ability to order an HIV RNA test and a person has an indication for HIV PrEP, many experts would prescribe HIV PrEP and perform the best available test for HIV screening. For individuals receiving lenacapavir-SQ, monitoring of HIV RNA levels is not included in the routine recommended laboratory monitoring studies, since HIV infections are rare and the studies of lenacapavir-SQ for HIV PrEP have not identified issues with ambiguous laboratory results for the few individuals who acquired HIV while receiving lenacapavir-SQ for HIV PrEP. In addition, if a follow-up lenacapavir-SQ injection is given based on a negative rapid HIV antigen-antibody test, a confirmatory laboratory HIV antigen-antibody test should be obtained to confirm the negative rapid test result.

- **Monitoring Renal Function**: Monitoring for renal function should be performed for all persons receiving oral HIV PrEP. Renal function should be assessed every 6 months if the individual is 50 years of age and older, or they have a baseline estimated creatinine clearance of less than 90 mL/min. Persons who are younger than 50 years of age and who have a baseline estimated creatinine clearance of at least 90 mL/min should have renal monitoring every 12 months. Monitoring of renal function is not necessary for persons receiving cabotegravir-IM or lenacapavir-SQ.

- **Lipid Panel and Weight Monitoring**: Persons receiving tenofovir-alafenamide should have monitoring every 12 months for cholesterol levels, triglyceride levels, and weight.
- **Hepatitis C Serology**: Repeat hepatitis C serologic testing should be performed every 12 months for men who have sex with men and people who inject drugs.
- **Sexually Transmitted Infections (STIs)**: For men who have sex with men, screening for bacterial STIs (chlamydia, gonorrhea, and syphilis) should occur at least every 3–6 months if taking oral HIV PrEP or lenacapavir-SQ and at least every 4 months if receiving injectable cabotegravir. For heterosexually active women and men who are taking oral HIV PrEP or receiving injectable cabotegravir, screening for syphilis and gonorrhea should occur at least every 6 months and screening for chlamydia at least every 12 months. Screening for chlamydia and gonorrhea should use NAAT and include all appropriate body sites based on reported sexual activity.
- **Pregnancy Testing**: For women who might become pregnant while taking HIV PrEP, pregnancy testing should be performed at least every 3–6 months. If a woman becomes pregnant (or is breastfeeding) while taking HV PrEP, the clinician prescribing HIV PrEP should have a discussion with

the woman and their prenatal medical provider about the risks and benefits of continuing HIV PrEP during pregnancy.

Acquisition of HIV in the Setting of HIV PrEP

If HIV infection is documented at the baseline evaluation or via a follow-up evaluation, then a number of subsequent steps should occur.[4]

- **Laboratory Studies**: In persons newly diagnosed with HIV, laboratory studies should be ordered that include a quantitative HIV RNA level (if not already performed as part of the diagnostic evaluation), a CD4 cell count, and an HIV genotype resistance assay (if the HIV RNA level is high enough to perform the genotype, which typically means higher than 200 to 500 copies/mL). If an individual is receiving or has received cabotegravir-IM for HIV PrEP and acquires HIV, the HIV genotypic resistance testing should include an integrase resistance assay (the integrase genotype typically requires a separate order from the standard genotype).[51] It is extremely important to order and obtain the drug resistance test prior to starting antiretroviral treatment for HIV. If a person acquires HIV while receiving lenacapavir-SQ, there is a risk for capsid inhibitor resistance, but there is no commercially available test for capsid resistance. Since lenacapavir resistance should not adversely impact any of the preferred initial antiretroviral treatment regimens, only a standard HIV genotype resistance assay is indicated for individuals who have received lenacapavir-SQ and acquire HIV.
- **Initiating Antiretroviral Treatment Regimen**: Once a diagnosis of HIV is made, it is important to promptly initiate a fully suppressive HIV treatment regimen.[6] The antiretroviral regimen can be modified, if needed, when the results from the genotype become available.[52] In general, if a person acquires HIV and has current or recent exposure to oral HIV PrEP (tenofovir DF-emtricitabine or tenofovir alafenamide-emtricitabine) or lenacapavir-SQ, the antiretroviral treatment should consist of a potent integrase inhibitor-based regimen: bictegravir-tenofovir alafenamide-emtricitabine or dolutegravir in combination with either tenofovir alafenamide-emtricitabine or tenofovir DF-emtricitabine.[52] If, however, a person acquires HIV and has current or prior exposure to cabotegravir-IM, the recommended initial antiretroviral therapy regimen is boosted darunavir plus either tenofovir DF-emtricitabine or tenofovir alafenamide-emtricitabine. The boosted darunavir can be switched to an integrase inhibitor if the integrase genotype confirms no resistance.[52]
- **Provide or Link to HIV Treatment Services**: If the clinician prescribing PrEP is not experienced with HIV management and antiretroviral therapy, then the person newly diagnosed with HIV should receive a referral to a medical provider who has significant HIV clinical treatment expertise.
- **Counseling and Partner Notification**: The person newly diagnosed with HIV should receive counseling about their HIV status and steps they should take to prevent HIV transmission to others. Partner notification should occur with all persons newly diagnosed with HIV.

HIV PrEP and Development of HIV Drug Resistance

HIV Drug Resistance in Persons Taking HIV PrEP

Although development of drug resistance is a concern for an individual who acquires HIV while taking tenofovir DF-emtricitabine, tenofovir alafenamide-emtricitabine, cabotegravir-IM, or lenacapavir-SQ, large HIV PrEP trials have reported low rates of developing HIV resistance when taking HIV PrEP.[13,36,53,54] Available data suggest the risk and extent of HIV drug resistance is reduced if baseline HIV infection is stringently ruled out prior to starting HIV PrEP and persons receiving HIV PrEP have regular HIV testing.

- **Resistance with Oral HIV PrEP**: In the iPrEx study, only 2 of the 48 persons taking tenofovir DF-emtricitabine who acquired HIV showed resistance mutations, and these minor variant mutations (e.g., M184I) were detected only with deep sequencing.[53] In the Partners PrEP study, 5 of 63 (7.9%) seroconverters in the active HIV PrEP arms of the study developed HIV drug resistance, and resistance was more common in persons assigned to the tenofovir DF-emtricitabine arm compared with the tenofovir DF only arm.[54]
- **Resistance with Cabotegravir-IM**: In the cabotegravir HPTN 083 study, resistance to integrase strand transfer inhibitors was documented in 4 of 9 breakthrough infections among persons in the cabotegravir arm; reverse transcriptase inhibitor mutations (K65R, M184V, M184I) were observed in 4 persons who had breakthrough HIV infections while taking tenofovir DF-emtricitabine.[13]
- **Resistance with Lenacapavir-SQ**: In the PURPOSE 2 trial, 2 of the 2,179 participants in the lenacapavir-SQ arm acquired HIV and both had a N74D capsid mutation.[35,55] Although capsid inhibitor resistance mutations can occur when a person acquires HIV after receiving lenacapavir-SQ for HIV PrEP, the rate of acquiring HIV while receiving this PrEP medication is extremely low, so the overall impact is likely small.

Evaluation for Suspected HIV Drug Resistance

An HIV RNA level and an HIV genotype drug resistance assay should be ordered promptly for any person taking HIV PrEP who is diagnosed with HIV.[4] Some individuals who acquire HIV while taking HIV PrEP may have detectable HIV RNA but at a level below the range for reliable performance of HIV genotyping. This scenario occurs because HIV PrEP medications can partially suppress viral replication. In this setting, HIV DNA genotyping, which can be performed with very low or undetectable HIV RNA levels, could be considered. If a person acquires HIV with current or prior use of oral HIV PrEP (tenofovir DF-emtricitabine or tenofovir alafenamide-emtricitabine) or lenacapavir-SQ, the baseline genotype upon diagnosis of HIV can be a standard genotype (assesses for mutations in the reverse transcriptase and protease genes). If, however, a person acquires HIV and is currently or has previously received cabotegravir-IM, regardless of the time since last injection, the baseline genotype should also include a check for resistance-associated mutations in the integrase gene. Depending on the lab, evaluation of Integrase resistance may require a separate order. At this time, commercially-available capsid HIV drug resistance testing is not available, but information on capsid resistance would not alter the standard recommended choices for the preferred initial antiretroviral regimens.

Adverse Effects of Medications Used for HIV PrEP

Adverse Effects with Tenofovir DF-Emtricitabine

In several large studies in which tenofovir DF-emtricitabine was used for HIV PrEP, the medication was well tolerated and safe. The most common side effects reported in the HIV PrEP studies were nausea and decreased appetite, primarily occurring in the first month of taking the drug (sometimes referred to as “start-up syndrome”).[3,43] These side effects typically resolve after the first month. Tenofovir DF can cause renal dysfunction, specifically proximal tubulopathy, but renal adverse events in large trials of HIV PrEP were either similar to or only slightly more common than with placebo, and resolved with discontinuation of the medication.[56,57,58] Nevertheless, extensive treatment experience with tenofovir DF when used as treatment for persons with HIV infection has shown the potential for tenofovir DF to cause nephrotoxicity. Therefore, monitoring of renal function is recommended in all persons taking tenofovir DF-emtricitabine for HIV PrEP.[43] Concern also exists regarding the effects of tenofovir DF on bone mineral density. Toxicity data from HIV PrEP studies have demonstrated a small, clinically insignificant, and reversible decrease in bone mineral density in participants who took tenofovir DF-emtricitabine.[59,60,61,62] Routine baseline (or follow-up) bone density scanning is not considered necessary. For a person who has documented osteoporosis or osteopenia or risk factors for such, some experts would opt for alternate HIV PrEP options if possible.

Adverse Effects with Tenofovir alafenamide-Emtricitabine

Tenofovir alafenamide-emtricitabine is usually well tolerated, with better bone and renal safety outcomes than tenofovir DF-emtricitabine.[31] Non-specific “start-up syndrome” symptoms may occur for some individuals, similar to symptoms that may occur with tenofovir DF-emtricitabine. Weight gain, increases in cholesterol, and increases in triglyceride levels are more likely with tenofovir alafenamide-emtricitabine than tenofovir DF-emtricitabine, but these changes are relatively minor and long-term consequences are not clear.[4,31]

Cabotegravir-IM

Among persons receiving cabotegravir-IM, the most common adverse effect is injection site reactions, which resulted in the discontinuation of cabotegravir in about 2% of persons receiving this medication.[13] In the cabotegravir HPTN 083 study, among persons who experienced an injection site reaction, the most common symptoms were pain (61%) and tenderness (24%).[13] Injection site reactions typically begin about 1 day after the injection and last about 3 days.[13] Most injection site reactions are mild, self-limited, and do not lead to discontinuation of the medication. Hot or cold packs and as-needed oral analgesics (anti-inflammatory medications and acetaminophen) can help to alleviate symptoms.

Lenacapavir-SQ

Among persons receiving lenacapavir-SQ, injection site reactions can occur as an immediate-onset inflammatory reaction or delayed long-lasting subcutaneous nodular reaction.[35,38] The immediate-onset reactions manifest within several hours (up to 48 hours) after the injection and are characterized by pain, swelling, and erythema. [35,38] The delayed long-lasting reactions usually begin to develop several days after the injection; these reactions are characterized by subcutaneous nodes and typically persist for 6–12 months.[13] Most injection site reactions do not cause discontinuation of lenacapavir-SQ. Pre- and post-injection ice packs applied at the injection site can help to reduce the immediate onset reactions, but there are no established measures to prevent the long-lasting nodular reactions.

Discontinuing HIV PrEP

There are a number of factors that may lead an individual to discontinue HIV PrEP, including a decline in HIV risk activity, medication-related side effects, or a positive HIV test. In general, HIV PrEP is indicated during periods of substantial risk of acquiring HIV, which may last for months or even years, but it should not typically be viewed as a life-long prevention strategy.[3] Several key factors should be taken into consideration at the time of discontinuing PrEP:[4]

- Upon discontinuation of HIV PrEP, repeat HIV testing should always be performed, and the reason for discontinuing HIV PrEP should be documented in the health record. If, at a later point, an individual wants to restart PrEP, they should undergo the same evaluation as a person newly prescribed HIV PrEP.
- For an individual planning to discontinue oral HIV PrEP (tenofovir DF-emtricitabine or tenofovir alafenamide-emtricitabine), the protection from HIV infection will wane within several days after stopping the medication.
- If an individual has chronic HBV infection and discontinues taking HIV PrEP with either tenofovir DF-emtricitabine or tenofovir alafenamide-emtricitabine, several months of monitoring for a possible HBV flare should occur, or consideration given for the treatment of chronic HBV, if indicated.
- When cabotegravir-IM is discontinued, levels of the medication may remain in tissues for a year or longer (up to 4 years in some individuals).[63] If a person discontinues cabotegravir-IM but has an ongoing risk for HIV acquisition, oral HIV PrEP should be recommended as a high priority during the cabotegravir “tail period,” which can last 1 year or longer. In this setting, the oral HIV PrEP (tenofovir DF-emtricitabine or tenofovir alafenamide-emtricitabine) should be prescribed within 2 months of the last cabotegravir-IM dose. Alternatively, if an individual wishes to switch to lenacapavir-SQ from cabotegravir-IM, the initial dosing of lenacapavir-SQ should be completed within 2 months of the last cabotegravir-IM dose. All individuals who stop cabotegravir-IM should have quarterly follow-up visits that include HIV testing for at least 12 months after the last injection of cabotegravir-IM.
- If a person discontinues lenacapavir-SQ, the levels of this medication may remain for at least 12 months. Therefore, if a person discontinues lenacapavir-SQ, but has an ongoing risk of HIV acquisition, oral HIV PrEP should be recommended as a high priority during the lenacapavir “tail period,” which can last 1 year or longer.
- If the individual discontinues HIV PrEP for any reason other than acquiring HIV, they should continue to have HIV testing performed, linkage to HIV prevention support services, and continued risk-reduction counseling.

Transitioning from Nonoccupational HIV PEP to PrEP

Indications for Transition from HIV nPEP to PrEP

All persons who receive one or more courses of HIV nonoccupational postexposure prophylaxis (nPEP) and have ongoing or anticipated near-future risk of acquiring HIV should be considered for HIV PrEP. For persons with repeated exposures to HIV, the use of HIV PrEP is preferable to repeated courses of nonoccupational PEP.[4] At the initial visit for persons undergoing evaluation for nonoccupational PEP, the discussion should include information regarding potential transition to HIV PrEP after completing the 28-day course of nonoccupational HIV PEP.

Timing of the Transition from HIV nPEP to PrEP

For persons receiving nonoccupational HIV PEP who are candidates to receive HIV PrEP, the transition from nonoccupational HIV PEP to HIV PrEP should occur without any gap in protection for HIV infection (i.e., the transition should be immediate from the completion of 28 days of HIV PEP to initiation of HIV PrEP on the subsequent day).[4,6,64] The major concern with immediate transition to HIV PrEP is that an individual could have acquired HIV from the exposure that warranted receipt of nonoccupational HIV PEP. If this occurred, the potential for development of HIV resistance would be significant because the individual would be transitioning from nonoccupational PEP (a three-drug regimen) to oral HIV PrEP (a 2-drug oral regimen) or long acting injectable medication (cabotegravir-IM or lenacapavir-SQ). This risk, however, appears to be very low, especially if adherence is good with occupational HIV PEP and if baseline HIV testing is performed prior to the actual transition.

Evaluation When Transitioning from HIV nPEP to PrEP

The following clinical and laboratory evaluation is recommended when transitioning an individual immediately from nonoccupational HIV PEP to HIV PrEP.[4,6] This transition requires some logistical considerations to ensure the individual begins HIV PrEP immediately upon completing the 28-day nonoccupational PEP regimen.[4,6]

- For persons who are candidates for transition from nonoccupational HIV PEP to HIV PrEP, a follow-up visit will be needed at the completion of the 28-day nonoccupational HIV PEP regimen (or several days prior to completing the regimen). To ensure no gap in HIV protection occurs, it is important the visit does not take place on a date after completion of the 28-day course of nonoccupational HIV PEP.
- At this follow-up visit, the individual should have an assessment for any signs or symptoms that would suggest acute HIV. If an individual is presenting with an illness consistent with acute HIV, then HIV PrEP should be deferred while evaluation of acute HIV is undertaken, and this evaluation should include HIV RNA testing.
- Repeat HIV testing should be performed at this visit, ideally with a laboratory-based HIV-1/2 antigen-antibody immunoassay and an HIV RNA-1 assay. These assays typically require 1–3 days before results are available, which practically means they should be ordered several days prior to the end of the 28-day nonoccupational PEP course, or the person can transition to HIV PrEP at the 28-day visit while the results are pending, with the plan to immediately convert the HIV PrEP to HIV treatment if the HIV testing reveals HIV infection.
- At this visit, individuals transitioning to HIV PrEP should receive counseling about HIV PrEP, and baseline laboratory studies that are indicated should be obtained. The medication regimen can transition from the 3-drug nonoccupational PEP to any of the four HIV PrEP regimens (tenofovir DF-emtricitabine, tenofovir alafenamide-emtricitabine, cabotegravir-IM, or lenacapavir-SQ), as long as they are indicated for the individual.
- If HIV testing at any point prior to starting HIV PrEP (or while on HIV PrEP) confirms HIV infection, the individual will need prompt evaluation for the management of newly acquired HIV.

Summary Points

- The FDA-approved and recommended HIV PrEP medications are oral regimens (tenofovir DF-emtricitabine and oral tenofovir alafenamide-emtricitabine) and long-acting injectable medications (cabotegravir-IM and lenacapavir-SQ).
- HIV PrEP has been shown to be a safe and effective HIV prevention option for individuals at substantial risk of acquiring HIV. With oral HIV PrEP, medication adherence to HIV PrEP medications has been the single most important factor that impacts efficacy.
- A baseline laboratory evaluation, including baseline HIV antigen-antibody and HIV-1 RNA testing should be obtained prior to starting HIV PrEP. Laboratory monitoring should include HIV testing at least every 3 months for those on oral medications, at least every 4 months while receiving cabotegravir-IM, and at least every 6 months while receiving lenacapavir-SQ.
- For persons receiving oral HIV PrEP with tenofovir DF-emtricitabine or tenofovir alafenamide-emtricitabine, renal monitoring should occur every 6 or 12 months, depending on the individual's age and baseline estimated CrCl.
- The risk of developing HIV drug resistance associated with HIV PrEP can occur, but this risk is lowered if appropriate HIV testing is done at baseline and at regular time intervals.
- If an individual with chronic hepatitis B infection is taking oral HIV PrEP, discontinuing tenofovir DF-emtricitabine or tenofovir alafenamide-emtricitabine could lead to a serious hepatitis B flare.
- Transitioning from nonoccupational HIV PEP to HIV PrEP optimally involves an immediate transition without a gap.
- When discontinuing HIV PrEP, repeat HIV testing should always be performed, and the reason for discontinuation should be documented in the health record.

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Figures

Figure 1 (Image Series) - Basic Concepts for Types of HIV PrEP (Image Series) - Figure 1 (Image Series) - Basic Concepts for Types of HIV PrEP
Image 1A: Daily Oral HIV PrEP

Illustration: David H. Spach, MD

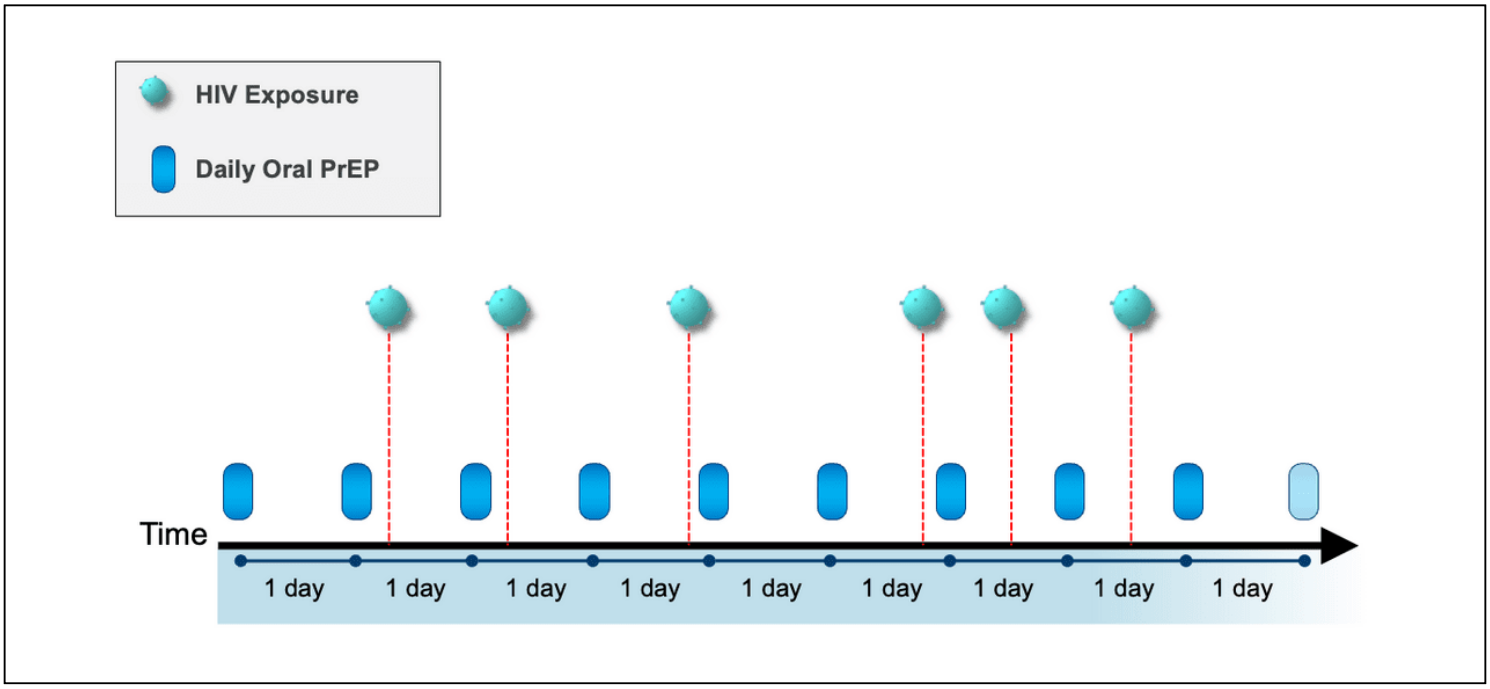

Figure 1 (Image Series) - Basic Concepts for Types of HIV PrEP
Image 1B: On-Demand (2-1-1) Oral HIV PrEP

Illustration: David H. Spach, MD

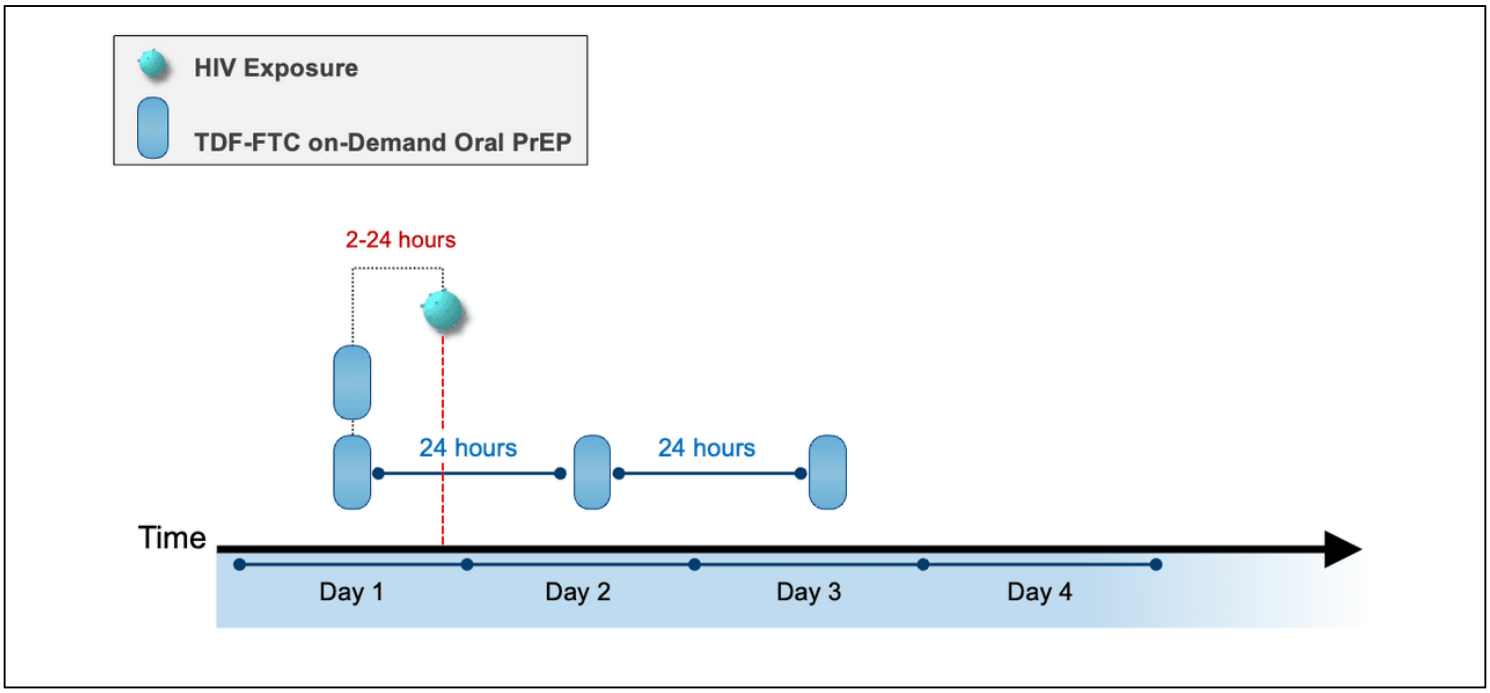

Figure 1 (Image Series) - Basic Concepts for Types of HIV PrEP
Image 1C: Long-Acting Cabotegravir-IM for HIV PrEP

Illustration: David H. Spach, MD

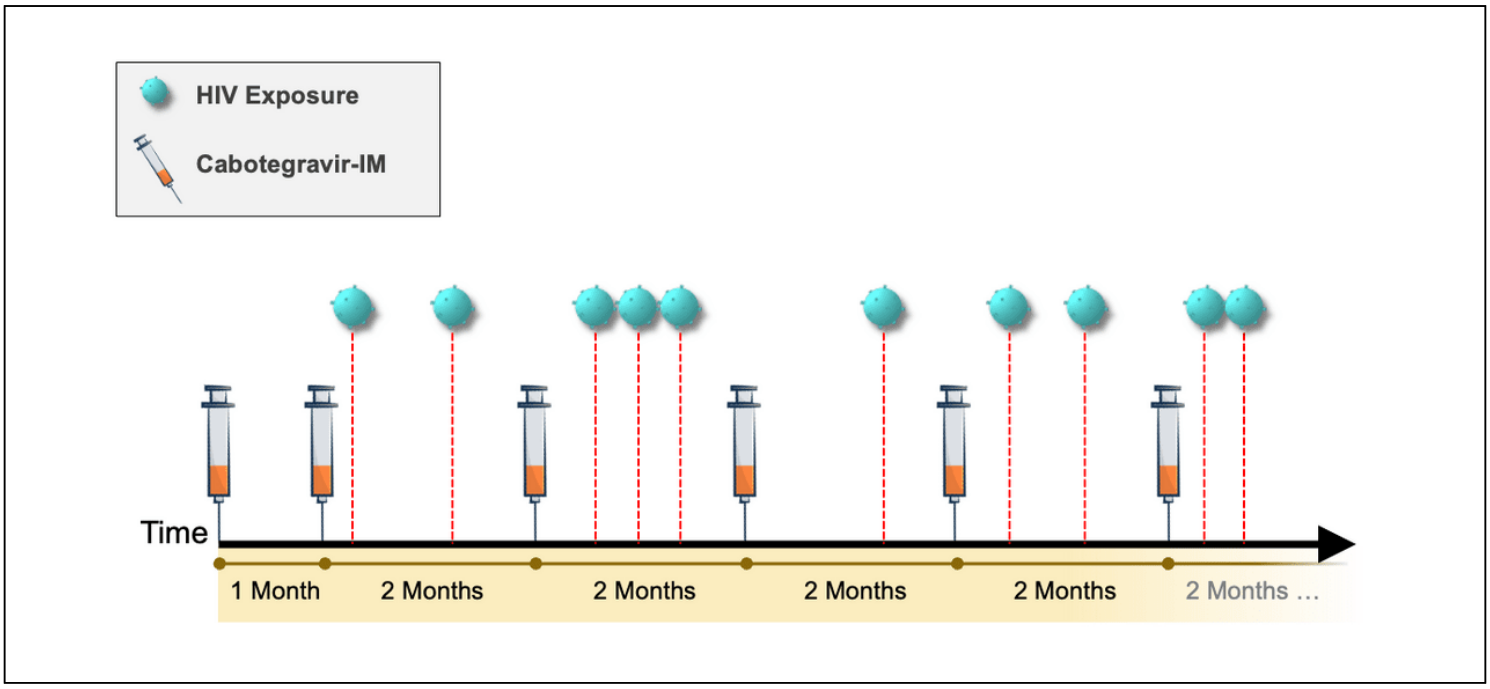

Figure 1 (Image Series) - Basic Concepts for Types of HIV PrEP
Image 1D: Long-Acting Lenacapavir SQ for HIV PrEP

Illustration: David H. Spach, MD

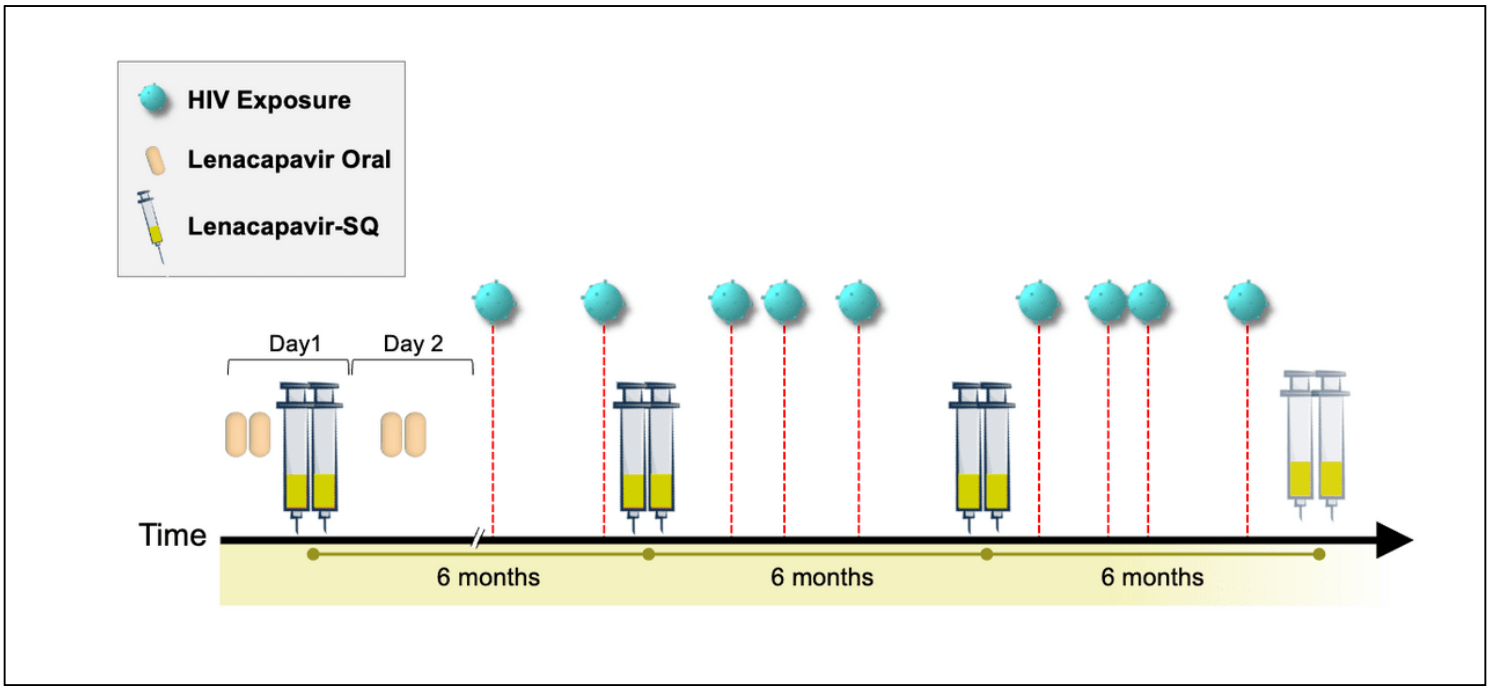

Figure 2 HIV PrEP Coverage, United States, 2017-2022

Source: (1) Centers for Disease Control and Prevention. Monitoring Selected National HIV Prevention and Care Objectives by Using HIV Surveillance Data United States and 6 Dependent Areas, 2021. HIV Surveillance Supplemental Report. 2023;28(No. 4):1-138. Published May 2023. (2) U.S. Health and Human Services. America's HIV Epidemic Analysis Dashboard (AHEAD). PrEP Coverage.

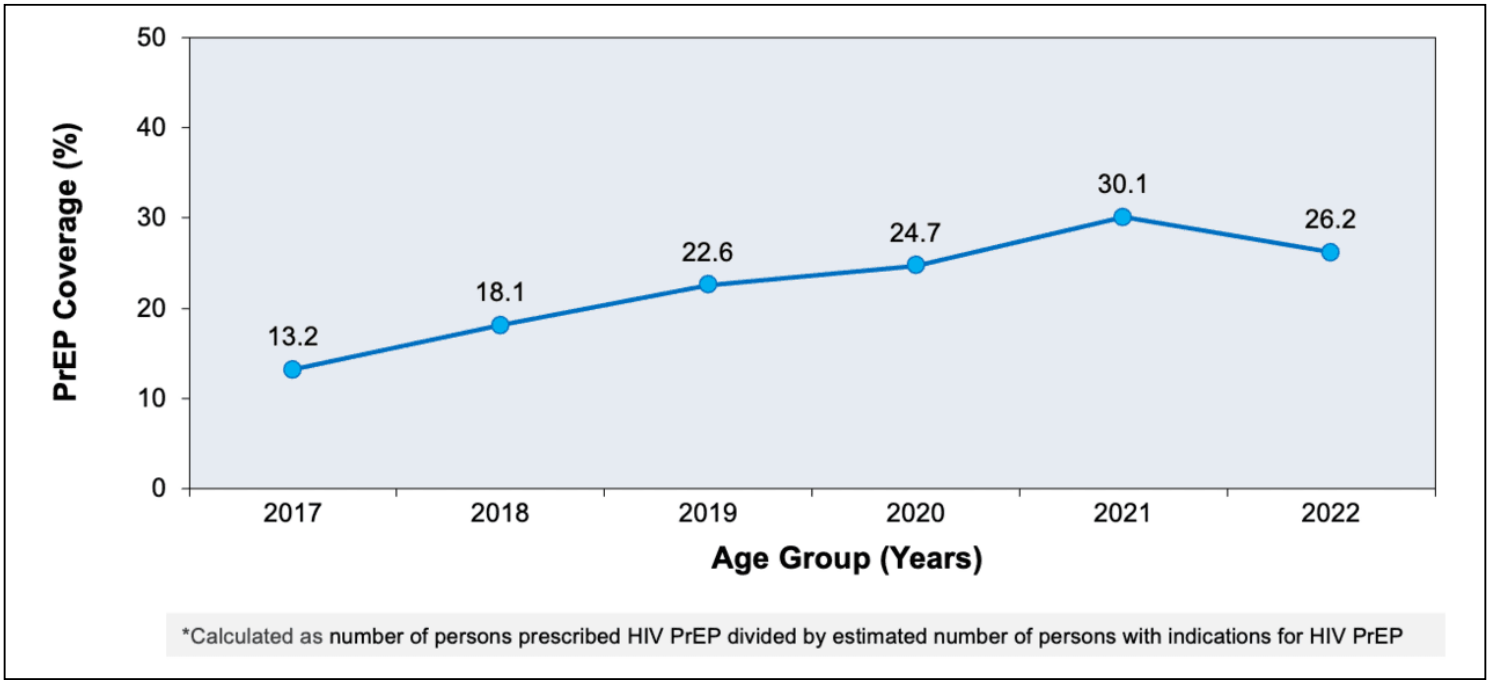

Figure 3 Estimates of PrEP Efficacy Adjusted for Adherence

In several of the key PrEP studies, efficacy is adjusted upward significantly when analyzing the data for persons with assumed adherence based on detectable antiretroviral drug levels.

Source: Marrazzo JM, del Rio C, Holtgrave DR, et al. HIV prevention in clinical care settings: 2014 recommendations of the International Antiviral Society-USA Panel. JAMA. 2014;312:390-409.