Preventing Perinatal HIV Transmission

This is a PDF version of the following document:
Module 5: Prevention of HIV
Lesson 1: Preventing Perinatal HIV Transmission

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Overview

Risk of Perinatal HIV Transmission

The World Health Organization estimates that nearly 10 million cases of perinatal HIV transmission have occurred globally since the beginning of the HIV epidemic, with most of these in resource-poor settings.[1] In the United States, the annual number of perinatal HIV infections peaked at 1,650 cases in 1991;[2,3] since 2013, the number of perinatal HIV infections in the United States has been fewer than 100 cases per year since 2017 (Figure 1).[4] In the United States, on an annual basis, approximately 3,000 pregnant persons with HIV give birth.[4,5] For pregnant persons with HIV, the estimated rate of perinatal transmission of HIV in the absence of intervention is approximately 25%; among children who acquire HIV perinatally, about 20% of the transmission events occur before 36 weeks of gestation, 50% between 36 weeks and delivery, and 30% during active labor and delivery.[6,7] With the use of suppressive combination antiretroviral therapy during pregnancy, followed by postnatal infant antiretroviral prophylaxis (and with the judicious use of elective cesarean section and the avoidance of breastfeeding), the current rate of perinatal HIV transmission rate in the United States is less than 1%.[8,9,10]

Impact of Antiretroviral Therapy on Perinatal HIV Transmission

- **Impact of Zidovudine Monotherapy**: In 1994, the landmark Pediatric AIDS Clinical Trials Group (PACTG) 076 trial established that a three-part zidovudine regimen reduced perinatal HIV transmission by 67.5% when compared with placebo (Figure 2).[6] In this trial, the three-part regimen consisted of (1) oral zidovudine initiated at 14 to 34 weeks of gestation and continued throughout pregnancy, (2) intravenous zidovudine given during labor and delivery, and (3) oral zidovudine given to the newborn for 6 weeks. The HIV transmission rate (determined at 18 months after birth) was 8.3% in the three-part zidovudine group compared to 25.5% in the placebo group.[6] Later that year, the U.S. Public Health Service (USPHS) issued guidelines recommending the use of zidovudine to reduce perinatal HIV transmission. The PACTG study and the subsequent USPHS recommendations spurred a dramatic decline in the number of cases of HIV perinatal transmission during the 1990s in the United States.[11]
- **Timing of Zidovudine Monotherapy**: In a retrospective study conducted in 1995-1997, investigators analyzed the relative benefit of zidovudine prophylaxis for the prevention of perinatal transmission of HIV based on the timing of when the zidovudine was administerred.[12] The greatest transmission benefit was seen with zidovudine therapy during pregnancy, but some benefit occurred even when zidovudine was administered later—as intravenous therapy in the intrapartum period or as oral therapy for the infant within 48 hours of birth (Figure 3).[12]

- **Impact of Combination Antiretroviral Therapy**: Clinical trials and observational studies in the United States, as well as clinical trials have demonstrated that a variety of antiretroviral regimens started in the prenatal period markedly reduce the risk of perinatal HIV transmission, with the greatest reduction in transmission occurring with use of combination antiretroviral therapy (Figure 4).[11,13,14,15]

Perinatal HIV Prevention and Care for Transgender or Gender Diverse Individuals

The current Perinatal HIV Clinical Guidelines for HIV prevention and care in the prepregnancy antepartum and postpartum periods are primarily driven by data from studies involving pregnant women or women of reproductive age, whose gender identity is not known. Studies on perinatal HIV prevention and care periods for individuals who are transgender or gender diverse are in nascent stages, with only limited data available. As such, for now, the Perinatal HIV Clinical Guidelines have opted to extrapolate the existing recommendations to transgender and gender-diverse persons with additional guidance provided if specific data is available for these populations. This is congruent with other HIV-related primary care and family planning guidelines and recommendations for gender minority populations.

Information and Consultation Resources

This topic review will highlight key points from the Perinatal HIV Clinical Guidelines.[16] The full text of the Perinatal HIV Clinical Guidelines should be consulted for all management decisions and for further reading. In addition, expert consultation can be obtained by calling the National Clinician Consultation Center's Perinatal HIV/AIDS Line at (888) 448-8765; this free resource provides information and clinical consultation to medical providers caring for pregnant persons with HIV and their infants.

HIV Testing During Pregnancy

Routine HIV Testing in Pregnancy

Multiple organizations strongly recommend routine opt-out HIV testing for all pregnant persons.[17,18,19,20] This recommendation is grounded in data that knowledge of HIV status during pregnancy provides an opportunity to (1) administer antiretroviral therapy to persons with HIV during pregnancy, (2) optimize strategies during delivery to minimize transmission risk, (3) give post-delivery antiretroviral therapy to the newborn, and (4) counsel on avoiding breastfeeding—all of which markedly reduce the risk of perinatal HIV transmission. In addition, the partners of all pregnant persons should undergo testing for HIV if their status is unknown.[20] All pregnant persons should have the HIV testing performed as early as possible in the pregnancy.[20] The recommendation to test all pregnant persons for HIV applies to persons presenting at any stage of pregnancy, including during labor.[20] Maternal HIV test results should be communicated to the newborn's medical provider and documented in the newborn's chart.[20]

Repeat Testing During Pregnancy

It is also important to remember that pregnant persons with a negative HIV test result in the first trimester of pregnancy should undergo repeat HIV testing in the third trimester if they have increased risk for HIV acquisition.[19,20] Repeat HIV testing in the third trimester should also be done for pregnant persons who have a sex partner with HIV who has a detectable (or unknown) HIV RNA level, those receiving care in facilities that have an HIV incidence of at least 1 case per 1,000 pregnant people per year, those who reside in jurisdictions with elevated HIV incidence, and those who reside in states that mandate third-trimester testing.[20] In addition, repeat third trimester HIV testing should be performed if a pregnant person has a suspected or confirmed diagnosis of a sexually transmitted infection (STI).[20] Individuals with a confirmed STI and a confirmed negative HIV test should be referred for HIV preexposure prophylaxis (PrEP). Further, any pregnant or breastfeeding person who presents with symptoms suggestive of acute HIV should have prompt diagnostic evaluation for acute HIV (HIV-1/2 antigen antibody and HIV RNA testing), even if they have previously undergone HIV testing during the pregnancy.[20,21] Pregnant persons who present in labor with unknown HIV status (or who are at high risk for HIV acquisition but have not undergone repeat third-trimester HIV testing), should have an expedited HIV test (i.e., results available within 1 hour) performed during labor. If that is not feasible, then expedited HIV testing should be done in the immediate postpartum period.[20]

Antepartum Management

Indications for Antiretroviral Therapy in Pregnancy

The Perinatal HIV Clinical Guidelines recommend using combination antiretroviral therapy for all pregnant persons with HIV, regardless of CD4 count or HIV RNA level, to decrease the risk of perinatal HIV transmission and to benefit the pregnant person's health.[15,22,23] All instances of antiretroviral exposure during pregnancy should be reported online to the Antiretroviral Pregnancy Registry. The risk of perinatal HIV transmission increases with higher maternal plasma HIV RNA levels, but transmission can occur in pregnant persons who have low plasma HIV RNA levels.[24] Therefore, even pregnant persons with a low plasma HIV RNA level should receive antiretroviral therapy. Regardless of antiretroviral therapy use, pregnant persons with HIV may be at risk for adverse outcomes, such as hypertensive pregnancy disorders or neonatal complications, including preterm delivery, low birth weight infants, or stillbirth.

Timing of Initiating Antiretroviral Therapy in Pregnancy

Due to the overwhelming benefits of antiretroviral therapy in preventing perinatal HIV transmission, the Perinatal HIV Clinical Guidelines recommend that all persons with HIV who become pregnant and are not receiving antiretroviral therapy should start antiretroviral therapy without delay.[22] Prior to starting antiretroviral therapy, HIV genotypic drug-resistance testing should be ordered, but treatment should not be delayed while waiting for the drug resistance test results; the antiretroviral regimen can subsequently be modified if needed, based on the HIV drug resistance test results.[22] Given that approximately 50% of perinatal transmissions occur between 36 weeks and the time of birth, intense efforts are warranted to lower HIV RNA levels as much as possible prior to the delivery, even for those individuals who are diagnosed with HIV late in pregnancy.[1,7]

Dolutegravir During Pregnancy (and in Persons Trying to Conceive)

Based on preliminary data from an observational surveillance study of birth outcomes in a cohort of pregnant women with HIV in Botswana who received dolutegravir, in May 2018, the U.S. Food and Drug Administration (FDA) issued a safety alert that warned of potential serious neural tube birth defects in infants born to mothers who received dolutegravir at the time of becoming pregnant or early in the first trimester.[25] Subsequently, however, these data from Botswana were updated in two subsequent studies, and investigators have shown the rate of neural tube defects was not statistically increased in pregnant women with HIV who received an antiretroviral regimen that contained dolutegravir when compared with regimens that did not contain dolutegravir.[26,27] Another multicenter, open-label, randomized, controlled trial enrolled approximately 600 pregnant women with HIV in 9 countries to receive one of three different antiretroviral regimens at 14 to 28 weeks of gestation: (1) dolutegravir plus tenofovir alafenamide-emtricitabine, (2) dolutegravir plus tenofovir DF-emtricitabine, or (3) efavirenz plus tenofovir DF-emtricitabine.[28] The dolutegravir-containing regimens, especially when combined with tenofovir alafenamide-emtricitabine, had more rapid rates of virological suppression and better safety profile when compared with the efavirenz-anchored regimen.[28] Taking into account the updated data and the known benefits of dolutegravir as a potent, well-tolerated antiretroviral agent that provides rapid and sustained viral suppression, the Perinatal HIV Clinical Guidelines now recommend that dolutegravir is a preferred anchor drug for persons trying to conceive and for pregnant persons, regardless of trimester.[15,29,30,31]

Recommended Regimens in Treatment-Naïve Pregnant Persons

The Perinatal HIV Clinical Guidelines provide recommendations for initial combination regimens for antiretroviral-naïve pregnant persons that include four categories: preferred, alternative, insufficient data, and not recommended.[29]

Preferred Initial Regimens

The preferred antiretroviral regimens for use in pregnancy consist of a dual nucleoside reverse transcriptase inhibitor (NRTI) backbone combined with an anchor drug, either (1) dolutegravir—an integrase strand transfer inhibitor (INSTI)—or (2) ritonavir-boosted darunavir—a protease inhibitor (PI).[29] The preferred dual NRTIs are: abacavir plus lamivudine; tenofovir DF plus either emtricitabine or lamivudine or tenofovir alafenamide plus either emtricitabine or lamivudine.[29] Note that dolutegravir is preferred as the anchor drug if the patient has not had prior use of injectable cabotegravir.[29] In contrast, for individuals who have previously been exposed to injectable cabotegravir, the preferred anchor drug is ritonavir-boosted darunavir; this recommendation is based on concern about possible INSTI resistance.[29]

Table 1. **Perinatal Guidelines: Recommendations for Use of Antiretroviral Drugs During Pregnancy**

***Preferred* Initial Regimens in Pregnancy**

Drugs or drug combinations are designated as *Preferred* for therapy during pregnancy when clinical trial data in adults have demonstrated efficacy and durability with acceptable toxicity and ease of use, and pregnancy-specific pharmacokinetic data are available to guide dosing. In addition, the available data must suggest a favorable risk-benefit balance for the drug or drug combination compared to other antiretroviral drug options; the assessment of risks and benefits should incorporate outcomes for maternal, pregnancy, fetal, and infant outcomes. Some *Preferred* drugs or regimens may have minimal toxicity or teratogenicity risks that are offset by other advantages for people with HIV who are pregnant or who are trying to conceive. Therefore, it is important to read all the information on each drug in the *Perinatal Guidelines* before administering any of these medications to patients.

***Preferred* Dual-NRTI Backbones**	**Advantages**	**Disadvantages**
Abacavir-lamivudine	• Once-daily dosing • Available as a fixed-dose combination • Well-tolerated during pregnancy • Reassuring PK data during pregnancy	• Requires HLA-B*5701 testing before Abacavir sh**ould not be used** in pa who test positive for HLA-B*5701 be of the risk of developing a hypersensitivity reaction. Requires education about hypersensitivity reactions.

	• Available as fixed-dose combination. Can be administered once daily.	• Not able to be used with hepatitis B virus/HIV confection • Abacavir lamivudine administered w atazanavir-ritonavir or efavirenz is r recommended if pretreatment HIV R >100,000 copies/mL. • Abacavir is not recommended as pa regimens for initial treatment of ear (acute or recent) HIV infection since requires HLA-B*5701 testing before When results of HLA-B*5701 testing not available, use of tenofovir DF or tenofovir alafenamide rather than abacavir will avoid delays in initiatir ART.
Tenofovir alafenamide-emtricitabine *or* Tenofovir alafenamide plus lamivudine	• Once-daily dosing • Available as a fixed-dose combination • Reassuring PK data and extensive use during pregnancy; no dose adjustment required in pregnancy • Activity against hepatitis B virus • Minimal toxicity compared to zidovudine-lamivudine • When combined with dolutegravir, the efficacy and toxicity of tenofovir alafenamide-emtricitabine and tenofovir DF-emtricitabine for treatment of pregnant patients are similar, but tenofovir alafenamide-emtricitabine is associated with fewer adverse birth outcomes and less risk of insufficient weight gain in pregnancy.	• When combined with dolutegravir, tenofovir alafenamide-emtricitabine associated with more treatment-emergent obesity in nonpregnant a women compared to tenofovir DF-emtricitabine. (Notably, the impact weight gain in pregnancy may be beneficial, as noted in the Advantag column.)
Tenofovir DF-emtricitabine *or* Tenofovir DF plus lamivudine	• Once-daily dosing • Available as a fixed-dose combination • Reassuring PK data during pregnancy; no dose adjustment required in pregnancy • Activity against hepatitis B virus • When combined with dolutegravir, the efficacy and toxicity of tenofovir alafenamide-emtricitabine and tenofovir DF-emtricitabine for treatment of pregnant patients are similar.	• Potential concerns about fetal bone early-life growth abnormalities with tenofovir DF, although clinical findir are reassuring to date • Tenofovir DF has potential renal tox thus, tenofovir DF-based, dual-NRTI combinations should be used with c in patients with renal insufficiency.
***Preferred* INSTI R**	**Advantages**	**Disadvantages**

egimens		
Dolutegravir-abacavir-lamivudine *or* Dolutegravir plus a *Preferred* Dual-NRTI Backbone	• Once-daily dosing • Dolutegravir-abacavir-lamivudine is available as a fixed-dose combination. • Sufficient data about PK, efficacy, and safety of dolutegravir in pregnancy • High rates of viral suppression • Dose adjustments during pregnancy are not needed. • May be particularly useful when drug interactions or the potential for preterm delivery with a PI-based regimen are a concern. • Dolutegravir has been shown to rapidly decrease viral load in ARV-naive pregnant women who present to care later in pregnancy. In nonpregnant adults, dolutegravir is associated with lower rates of INSTI resistance than raltegravir, and dolutegravir allows for once-daily dosing; for these reasons, dolutegravir is particularly useful for pregnant people presenting late in pregnancy. • Dolutegravir with a NRTI backbone of tenofovir alafenamide or Tenofovir DF with lamivudine or emtricitabine is the *Preferred* regimen for initial treatment in people with early (acute or recent) HIV infection in people without a history of cabotegravir exposure for PrEP.	• Potential concerns about excess we gain with dolutegravir • Dolutegravir-abacavir-lamivudine requires HLA-B*5701 testing before (see abacavir-lamivudine above). • Specific timing and/or fasting recommendations apply if dolutegra taken with calcium or iron (e.g., in prenatal vitamins. • Dolutegravir is not *Preferred* for init treatment in people with early (acut recent) HIV infection and a history c cabotegravir exposure for PrEP due concerns about INSTI resistance mutations; darunavir boosted with ritonavir is *Preferred* in this situatio
***Preferred* PI Regimens**	**Advantages**	**Disadvantages**
Darunavir boosted with ritonavir plus a *Preferred* Dual-NRTI Backbone	• When a PI-based regimen is indicated, atazanavir or darunavir is recommended over lopinavir-ritonavir. • Darunavir boosted with ritonavir plus an NRTI backbone of tenofovir alafenamide or tenofovir DF with lamivudine or emtricitabine is the *Preferred* regimen for initial treatment in people with early (acute or recent) HIV infection and a history of cabotegravir exposure for HIV PrEP.	• Not available as a fixed-dose combi • Requires twice-daily dosing during pregnancy • Requires administration with food • PIs may increase the risk of preterm
Abbreviations: NRTI = nucleoside reverse transcriptase inhibitor; INSTI = integrase strand transfer inhibitor; PI = protease inhibitor; ARV = antiretroviral; PK = pharmacokinetics; PrEP = preexposure prophylaxis		

Source:

- Panel on Treatment of HIV During Pregnancy and Prevention of Perinatal Transmission. Recommendations for the Use of Antiretroviral Drugs During Pregnancy and Interventions to Reduce Perinatal HIV Transmission in the United States. Antepartum Care. Recommendations for use of antiretroviral drugs during pregnancy. Table 6. What to start: initial antiretroviral regimens during pregnancy for people who are antiretroviral-naive. January 31, 2023. [HIV.gov]

Alternative Initial Regimens

The following table summarizes the recommendations for alternative initial regimens in pregnancy.

Table 2. **Perinatal Guidelines: Recommendations for Use of Antiretroviral Drugs During Pregnancy**

Alternative Initial Regimens in Pregnancy

Drugs or drug combinations are designated as *Alternative* options for therapy during pregnancy when clinical trial data in adults show efficacy and the data in pregnant individuals are generally favorable, but limited. Most *Alternative* drugs or regimens are associated with more PK, dosing, tolerability, formulation, administration, or interaction concerns than those in the

categor

y, but they are acceptable for use in pregnancy. Some *Alternative* drugs or regimens may have known toxicity or teratogenicity risks that are offset by other advantages for people with HIV who are pregnant or who are trying to conceive. Therefore, it is important to read all the information on each drug in the *Perinatal Guidelines* before administering any of these medications to patients.

***Alternative* INSTI**	**Advantages**	**Disadvantages**

Regimens		
Raltegravir plus a *Preferred* Dual-NRTI Backbone	• Reassuring safety data • Like dolutegravir, raltegravir may be particularly useful when drug interactions or the potential for preterm delivery with PI-based regimens are a concern. • PK data are available for raltegravir in pregnancy when using the twice-daily formulation (400 mg twice daily). • Like dolutegravir, raltegravir has been shown to rapidly decrease viral load in ARV-naive pregnant women who present to care later in pregnancy. In nonpregnant adults, dolutegravir is associated with lower rates of INSTI resistance than raltegravir, and dolutegravir permits once-daily dosing; for these reasons, dolutegravir is *Preferred*& and raltegravir is *Alternative* for use during pregnancy.	• Twice-daily dosin due to low drug le during pregnancy • Not available as a • Lower barrier to r this reason, ralteg pregnancy • PK data are not a mg (2 times; 600 formulation (ralte • Specific timing ar apply if raltegravi (e.g., in prenatal
***Alternative* PI Regimens**	**Advantages**	**Disadvantages**
Atazanavir boosted with ritonavir plus a *Preferred* Dual-NRTI Backbone	• Once-daily dosing • Extensive experience during pregnancy	• Not available as a • Associated with ir bilirubin levels, w the risk of neonat clinically significa kernicterus repor monitoring is reco • Requires increase trimester • Has been associa reductions in lang and late language • PIs may increase • Do not use with p • Requires consider H2 blockers, whic pregnancy.
***Alternative* NRTI Regimens**	**Advantages**	**Disadvantages**
Zidovudine-lamivudine	• Available as a fixed-dose combination • Significant experience during pregnancy	• Requires twice-da • Associated with h including nausea, maternal and ned • Other regimens h greater efficacy a
***Alternative* NNRTI Regimens**	**Advantages**	**Disadvantages**
Efavirenz-tenofovir DF-emtricitabine *or* Efavirenz-tenofovir DF-lamivudine *or*	• Once-daily dosing • Available as a fixed-dose combination • Extensive experience in pregnancy • Not associated with increased risk of neural tube defect or other congenital anomalies in human studies (although cautionary text based on animal studies remains in the package insert.	• Overall higher rat some *Preferred* d • Requires enhance suicidality • Increased risk of observed with Efa versus dolutegrav

Efavirenz plus a *Preferred* Dual-NRTI Backbone	• No dose changes are required during pregnancy. • Useful for patients who require treatment with drugs that have significant interactions with *Preferred* agents or who need the convenience of a coformulated, single-tablet, once-daily regimen and are not eligible for dolutegravir.	• emtricitabine star • Increased risk of t fatigue, hepatoto
Rilpivirine-tenofovir DF-emtricitabine or Rilpivirine-tenofovir alafenamide-emtricitabine Rilpivirine (oral) plus a *Preferred* Dual-NRTI Backbone	• Once-daily dosing • Available as a fixed-dose combination • Useful for patients who require treatment with drugs that have significant interactions with *Preferred* agents or who need the convenience of a coformulated, single-tablet, once-daily regimen and are not eligible for dolutegravir	• Limited use for in HIV RNA. RPV is n pretreatment HIV counts <200 cells • Requires close vir trimesters becaus levels. Insufficien • Do not use with p • Requires consider H2 blockers or pr commonly used d • Requires administ
Abbreviations: NRTI = nucleoside reverse transcriptase inhibitor; INSTI = integrase strand transfer inhibitor; PI = p antiretroviral; PK = pharmacokinetics; PrEP = preexposure prophylaxis		

Source:

- Panel on Treatment of HIV During Pregnancy and Prevention of Perinatal Transmission. Recommendations for the Use of Antiretroviral Drugs During Pregnancy and Interventions to Reduce Perinatal HIV Transmission in the United States. Antepartum Care. Recommendations for use of antiretroviral drugs during pregnancy. Table 6. What to start: initial antiretroviral regimens during pregnancy for people who are antiretroviral-naive. January 31, 2023. [HIV.gov]

Insufficient Data

The following table summarizes regimens for which there are insufficient data in pregnancy to recommend routine use in initial regimens.

Table 3. **Perinatal Guidelines: Recommendations for Use of Antiretroviral Drugs During Pregnancy**

***Insufficient Data* for Use as Initial Regimens in Pregnancy**

These drugs and drug combinations are approved for use in adults, but pregnancy-specific PK or safety data are too limited to make recommendations for use in pregnant people. When a pregnant person presents to care while virally suppressed on one of these drugs or drug combinations, providers should consider whether to continue their current regimen or switch to a recommended ARV regimen.

Insufficient Data	**Advantages**	**Disadvantages**
Bictegravir-tenofovir alafenamide-emtricitabine	• Coformulated as a single, once-daily pill • High barrier to resistance • No food requirement	• Limited PK, toxici • May be associate • Specific timing ar apply if bictegrav (e.g., in prenatal
Doravirine	• Coformulated with tenofovir DF-lamivudine as single table	• Limited PK, toxici • Initial studies sug

or Doravirine-tenofovir DF-lamivudine	• No food requirement		in third trimester.
Abbreviations: ARV = antiretroviral; PK = pharmacokinetics			

Source:

- Panel on Treatment of HIV During Pregnancy and Prevention of Perinatal Transmission. Recommendations for the Use of Antiretroviral Drugs During Pregnancy and Interventions to Reduce Perinatal HIV Transmission in the United States. Antepartum Care. Recommendations for use of antiretroviral drugs during pregnancy. Table 6. What to start: initial antiretroviral regimens during pregnancy for people who are antiretroviral-naive. January 31, 2023. [HIV.gov]

Not Recommended

There are some antiretroviral regimens that are not recommended for initial antiretroviral therapy in pregnancy and not recommended for initial use in pregnancy except in special circumstances.[29]

Persons on Antiretroviral Therapy Who Become Pregnant

In most circumstances, if a person with HIV is taking a fully suppressive combination antiretroviral regimen and becomes pregnant, they should continue the current antiretroviral regimen; discontinuing therapy could cause a viral rebound that could increase the risk of HIV transmission to the fetus.[32] There are several medications or regimens that require special consideration, including some that may require discontinuation.[32,33] The Perinatal HIV Clinical Guidelines provide detailed situation-specific recommendations for the use of antiretroviral drugs in pregnant people and nonpregnant people who are trying to conceive.[33] The following summarizes recommendations for several of these key recommendations.

- **Atazanavir**: Available data suggest that levels of atazanavir decline during pregnancy, even when given with a booster.[34,35] When atazanavir is used in pregnancy, it should be combined with low-dose ritonavir boosting, and it should be administered with food.[32,35] In addition, some experts recommend increasing the dose of atazanavir (from 300 mg once daily to 400 mg once daily) when combined with ritonavir, 100 mg once daily, during the second and third trimester—to generate levels similar to those in nonpregnant persons.[32,35] Initiating therapy with atazanavir-cobicistat is not recommended during pregnancy due to concerns about lowered drug levels.[35] If, however, a person becomes pregnant while taking a fully suppressive antiretroviral regimen that contains atazanavir-cobicistat, the regimen may be continued (provided there is frequent viral load monitoring throughout the pregnancy), or it can be switched to a more effective and preferred regimen for use during pregnancy.[32,33]
- **Bictegravir**: At present, bictegravir is only available as the fixed-drug bictegravir-tenofovir alafenamide-emtricitabine. There are insufficient data to recommend use of a bictegravir-containing regimen in pregnancy at this time.[32,33] If an individual with viral suppression is taking bictegravir-tenofovir alafenamide-emtricitabine and becomes pregnant, then the decision regarding whether to switch must be made in consultation with the clinical provider, taking into account the possibility of viral rebound that may occur during a regimen change.[32,33] If the decision is made to continue the same regimen, then plasma HIV RNA levels should be monitored more frequently, typically every 1 to 2 months.[32,33]
- **Cobicistat-Boosted Regiments**: Data from the IMPAACT P1026s protocol study suggest that pregnant persons taking a regimen that includes elvitegravir-cobicistat have significantly reduced drug levels of elvitegravir and cobicistat during the third trimester of pregnancy, which would presumably lead to an increased risk of virologic failure late in the pregnancy.[36] Similar concern has

been raised with regimens containing atazanavir-cobicistat or darunavir-cobicistat. As such, initiating antiretroviral therapy with a cobicistat-containing regimen is not recommended for pregnant individuals. If a person becomes pregnant while taking a fully suppressive antiretroviral regimen that includes cobicistat, the regimen may be continued, provided there is frequent viral load monitoring throughout the pregnancy.[32,33] Alternatively, the medical provider may consider switching to a more effective and preferred regimen for use during pregnancy.[32,33]

- **Darunavir**: Ritonavir-boosted darunavir is a preferred anchor drug for pregnant persons, regardless of trimester, and for persons trying to conceive, especially individuals who have a history of receiving injectable cabotegravir for preexposure prophylaxis.[29] It is, however, important to note that levels of darunavir significantly decline during pregnancy, even when given with a booster.[34,35] Accordingly, the recommended dosing during pregnancy is darunavir 600 mg twice daily given with ritonavir 100 mg twice daily taken with food; once-daily darunavir plus ritonavir is not recommended during pregnancy.[34,35] In addition, darunavir-cobicistat should not be initiated during pregnancy.[35] If, however, a person becomes pregnant while taking a fully suppressive antiretroviral regimen that contains darunavir-cobicistat, the regimen may be continued (provided there is frequent plasma HIV RNA level monitoring throughout the pregnancy), or it can be switched to a more effective and preferred regimen for use during pregnancy.[32,33]
- **Dolutegravir**: For persons trying to conceive and persons who are pregnant, regardless of trimester, dolutegravir is a preferred drug. Thus, dolutegravir should be continued in persons taking dolutegravir who become pregnant.[29,30,32]
- **Doravirine**: There are insufficient data on doravirine in pregnancy to recommend its use at this time. If an individual doing well with suppression of plasma HIV RNA levels on a doravirine-containing regimen becomes pregnant, then the decision regarding whether to switch must be made in consultation with the clinical provider, taking into account the possibility of viral rebound that may occur during a regimen change.[30,32] If the decision is made to continue the same regimen, then HIV RNA levels should be monitored more frequently, typically every 1 to 2 months.[30,32]
- **Efavirenz**: Individuals with HIV who are taking an efavirenz-based regimen and present for care during pregnancy, including during the first trimester, can continue to take efavirenz if the regimen is adequately suppressing plasma HIV RNA levels.[32] The rationale to permit efavirenz use in the first trimester is threefold: (1) the risk of neural tube defects is limited to the first 5 to 6 weeks of pregnancy, and confirmation of pregnancy typically occurs after week 6, (2) a meta-analysis that did not show an increased risk of birth defects among infants born to pregnant persons who had exposure to efavirenz during the first trimester of pregnancy,[37] and (3) unnecessary changes in antiretroviral therapy could lead to loss of suppression of HIV RNA levels.
- **Ibalizumab**: Animal studies suggest that infants exposed to ibalizumab during pregnancy may have reversible immunosuppression. If a person receiving ibalizumab becomes pregnant, expert consultation should be obtained.
- **Injectable Cabotegravir-Rilpivirine**: Data for the use of injectable cabotegravir-rilpivirine during pregnancy are limited. Accordingly, cabotegravir-rilpivirine should not be selected as first-line combination antiretrovirals in treatment-naïve pregnant persons or for those who are actively trying to conceive. For individuals who become pregnant while taking long-acting injectable cabotegravir-rilpivirine, expert consultation should be obtained. This regimen should be switched to a preferred oral 3-drug combination antiretroviral regimen, but this switch is complicated by the long half-life of injectable cabotegravir-rilpivirine. If the person remains on injectable cabotegravir-rilpivirine during pregnancy, more frequent HIV RNA monitoring is recommended.[32]
- **Oral Rilpivirine**: Although rilpivirine plasma levels are expected to decrease during the second and third trimester of pregnancy, the level of reduction is considered unlikely to result in virologic failure. Rilpivirine can be continued at standard doses during pregnancy, but maternal plasma HIV RNA levels should be monitored every 1 to 2 months during the second and third trimester of pregnancy.[32]
- **Oral Two-Drug Regimens**: There are limited data on the use of 2-drug regimens in pregnancy. Therefore, these oral two-drug regimens should not be selected as first-line combination antiretrovirals in treatment-naïve pregnant persons or for those who are actively trying to conceive. If an individual becomes pregnant while taking either dolutegravir-lamivudine or dolutegravir-rilpivirine, the clinician can consider continuing the same 2-drug regimen, provided the patient has viral

suppression, and if more frequent HIV RNA monitoring is conducted (typically every 1-2 months). Alternatively, the pregnant individual can be switched to a preferred 3-drug oral regimen recommended for use in pregnancy.

- **Tenofovir alafenamide**: Based on accumulating safety data, tenofovir alafenamide is now recommended as a preferred nucleoside reverse transcriptase inhibitor for people who are pregnant or are trying to conceive.[32] Persons who become pregnant while taking a fully suppressive combination antiretroviral regimen that includes tenofovir alafenamide can continue this medication.[33]

Pregnant Persons with Prior Antiretroviral Treatment but Not on Therapy

Some persons with HIV who become pregnant may have previously received antiretroviral therapy or antiretroviral prophylaxis but are not currently taking any antiretroviral medications at the time when they are first evaluated during their pregnancy. In this situation, it is very important to obtain detailed information regarding past regimens, tolerance of prior medications, adherence with past regimens, evidence of prior virologic failure, and resistance testing data, if available.[38] If the pregnant person's current HIV RNA level is above the threshold for resistance testing (e.g., greater than 500 to 1,000 copies/mL depending on the laboratory performing the testing), then resistance testing should be ordered prior to starting the antiretroviral regimen during the pregnancy. After the drug resistance test blood sample has been obtained, antiretroviral therapy should be started, with modification of the regimen as needed when results from the drug resistance test become available.[38] For pregnant persons who previously took antiretroviral therapy and had no history of virologic failure or HIV drug resistance, then reinitiating antiretroviral therapy is relatively straightforward. For treatment-experienced individuals with prior virologic failure and HIV drug resistance, genotypic drug resistance testing is recommended.[39] If the treatment-experienced person has suspected multidrug-resistant HIV, selecting an antiretroviral regimen is complicated, depends on drug-resistance testing, and should be done by or in conjunction with an HIV treatment specialist.[38]

Antiretroviral-Naïve Pregnant People who Present in the Third Trimester

Because INSTI-based regimens cause a very rapid decline in HIV RNA levels (estimated 2 log decline in 2 weeks), the Perinatal HIV Clinical Guidelines recommend using a dolutegravir-based antiretroviral regimen for pregnant people who are starting antiretroviral therapy late in pregnancy.[15,40,41]

Monitoring HIV RNA and CD4 Count During Pregnancy

- **HIV RNA Monitoring**: For pregnant persons with HIV, the Perinatal HIV Clinical Guidelines recommend the following for monitoring HIV RNA levels during pregnancy:[42]
    - All pregnant persons should have an HIV RNA level at the first antenatal visit.
    - For pregnant persons initiating (or changing) an antiretroviral drug regimen, check the HIV RNA level after 2 to 4 weeks and then monthly until RNA levels are undetectable.
    - In pregnant persons with undetectable HIV RNA levels, check HIV RNA levels at least every 3 months.
    - For all pregnant persons, check an HIV RNA at approximately 34 to 36 weeks of gestation to inform decisions about mode of delivery.
- **CD4 Cell Count Monitoring**: For pregnant persons with HIV, the Perinatal HIV Clinical Guidelines recommend the following for monitoring of CD4 cell count during pregnancy.[42]
    - All pregnant persons should have a CD4 cell count checked at the first antenatal visit.
    - Individuals who have been on antiretroviral therapy for at least 2 years with consistently suppressed HIV RNA levels and CD4 counts consistently greater than 300 cells/mm^3 do not need CD4 count monitoring after the initial antenatal visit during pregnancy.
    - Monitoring of CD4 cell counts should be conducted every 3 to 6 months during pregnancy for persons who have any of the following: (1) receipt of antiretroviral therapy for less than 2 years, (2) CD4 count less than 300 cells/mm^3, or (3) inconsistent adherence (and/or detectable

HIV RNA levels).

Pregnant People Who Have Not Achieved Viral Suppression

Management of pregnant persons who have not achieved virologic suppression is complex and should typically involve expert consultation or management by a specialist.[43] Management should include drug resistance testing if HIV RNA levels are adequately elevated (typically greater than 200 copies/mL) to perform resistance testing. In this situation, if the pregnant person is taking a three-drug antiretroviral regimen that does not already include an INSTI, some experts have recommended empirically adding an INSTI, particularly if the person is late in pregnancy.[40,44,45] The benefit of adding an INSTI in this setting remains unproven, and concerns exist that resistance could develop if this change alone is made.[43] Note: expert consultation can be obtained by The National Clinical Consultation Center Perinatal HIV/AIDS hotline (888-448-8765).

Intrapartum Management

For pregnant people with HIV, the major management decisions at the time of labor are whether to administer intravenous zidovudine and whether to perform cesarean section. These decisions are primarily based on the pregnant person's antiretroviral history during the pregnancy and recent HIV RNA levels. Pregnant people who have been taking combination antiretroviral therapy prior to onset of labor should continue taking their antiretroviral regimen on schedule (as good as possible) during and after labor.[46] If, however, the combination oral antiretroviral regimen includes zidovudine and the pregnant person receives intravenous zidovudine during labor, the oral zidovudine can be held while they receive intravenous zidovudine.[46]

In Labor without Antepartum Antiretroviral Therapy

Expedited HIV-1/2 antigen-antibody immunoassay is recommended for pregnant people who present in labor and have unknown HIV antibody status and for pregnant individuals who have high risk for HIV acquisition but were not tested for HIV during their third trimester of pregnancy.[46] In addition, any pregnant individual presenting in labor with symptoms of acute HIV (or with a history of a recent HIV exposure) should get an HIV RNA level in addition to an expedited HIV-1/2 antigen-antibody immunoassay.[46] Pregnant individuals who have a reactive test (preliminary positive) should be assumed to have HIV, and all available prevention measures (for the pregnant individual and the infant) should be initiated immediately to reduce the risk of perinatal transmission.[46] If the initial HIV-1/2 antigen-antibody immunoassay is positive, additional confirmatory testing should be performed with an HIV-1/2 differentiation assay and an HIV RNA level.[46] In this situation, the infant should immediately start on oral antiretroviral therapy, and potential continuation of antiretroviral therapy for the birth parent and infant will depend on the results of subsequent HIV confirmatory tests.[46]

- **Intrapartum Zidovudine**: Since a substantial proportion of perinatal HIV transmission occurs at or near the time of delivery, intrapartum intravenous zidovudine should be provided to all pregnant individuals with HIV who are newly diagnosed at the time of labor and to pregnant individuals with known HIV who are not taking antiretroviral therapy late in pregnancy.[46] The administration of intravenous zidovudine should include individuals who have a positive HIV-1/2 antigen-antibody Immunoassay, but confirmatory testing (HIV RNA and/or HIV antibody differentiation) results are not yet known. In these settings, the use of intrapartum and postpartum zidovudine for the newborn reduces the risk of perinatal HIV transmission from 27% to 10%.[12]
- **Cesarean Delivery**: Most experts recommend cesarean delivery for pregnant persons newly diagnosed with HIV at the time of labor and for those with known HIV who are not on antiretroviral therapy, since these individuals are likely to have an HIV RNA level above 1,000 copies/mL—the threshold for elective cesarean section.[46] Cesarean delivery is also recommended for pregnant people with HIV who have a known HIV RNA level greater than 1,000 copies/mL obtained within 4 weeks of delivery.[46] The benefit of cesarean section after rupture of membranes or onset of labor is unknown.

Guidance for Intravenous Zidovudine Use in Labor

Intravenous zidovudine, when given early in labor, rapidly crosses the placenta and thus can efficiently provide high systemic levels of zidovudine for the infant. Available data show the use of intravenous zidovudine in labor clearly reduces perinatal HIV transmission when the pregnant individual has an HIV RNA level greater than 1,000 copies/mL near the time of delivery—defined as 34 to 36 weeks of gestation or within 4 weeks before delivery.[47] Accordingly, the Perinatal HIV Clinical Guidelines recommendation for the use of intravenous zidovudine for the pregnant person during delivery depends on the individual's HIV RNA level near the time of delivery and whether there are any concerns for adherence with antiretroviral medication near delivery.[46]

- **HIV RNA Level >1,000 copies/mL**: Intravenous zidovudine during delivery is recommended if the pregnant individual's HIV RNA level near delivery is known to be greater than 1,000 copies/mL.
- **HIV RNA Level Unknown or Suspected to be >1,000 copies/mL**: Intravenous zidovudine during delivery is recommended if the pregnant individual's HIV RNA level near delivery is not known or it is suspected to be greater than 1,000 copies/mL. If there is doubt about a pregnant person's adherence with the antiretroviral therapy regimen near delivery, then intravenous zidovudine during delivery is recommended, regardless of the prior HIV RNA level.
- **HIV RNA Level between 50 and 1,000 copies/mL**: For pregnant people with HIV who have an HIV RNA level between 50 and 1,000 copies/mL within 4 weeks of delivery, inadequate data exist to guide a clear recommendation, but some experts would use intravenous zidovudine in this setting; these situations should be addressed, ideally with expert consultation, on a case-by-case basis.
- **Maternal HIV RNA Level ≤50 copies/mL**: The use of intrapartum zidovudine is not required in pregnant people who have an HIV RNA level equal to or less than 50 copies/mL within 4 weeks of delivery, if they are receiving and adhering with antiretroviral therapy.

Dosing of Zidovudine in Labor

For persons who present in labor, if indicated, intravenous zidovudine should ideally be started at the onset of active labor. The recommended intravenous dose of zidovudine during labor is a 2 mg/kg loading dose over the first hour, followed by a continuous infusion of 1 mg/kg/hour for at least 2 hours (total minimum of 3 hours); the intravenous zidovudine should be continued throughout labor until delivery.[35,46] If a cesarean section is scheduled, the same dosing is recommended, but the loading dose should ideally be started 3 hours before the procedure. The intravenous zidovudine should ideally be started at the onset of active labor. For pregnant people scheduled to have a cesarean delivery, the intravenous infusion should be started at least 3 hours prior to the scheduled delivery and continued until delivery.[46]

Single-dose Nevirapine in Labor is Not Recommended

The Perinatal HIV Clinical Guidelines do not recommend giving single-dose nevirapine during labor for any pregnant person with HIV in the United States, regardless of whether they have received antepartum combination antiretroviral therapy.[46]

Indications for Cesarean Section Delivery

The guidance for performing cesarean delivery for the purpose of preventing HIV transmission depends predominantly on the pregnant person's HIV RNA level near delivery. For this reason, obtaining an HIV RNA level at approximately 24 to 36 weeks' of gestation is recommended. Note that for pregnant people, HIV coinfection with either hepatitis C virus (HCV) or hepatitis B virus (HBV) is not an independent indication for cesarean section.[48,49] The Perinatal HIV Clinical Guidelines recommend the following based on the HIV RNA level of the pregnant person:[46]

- **HIV RNA Level >1,000 copies/mL**: A scheduled cesarean delivery at 38 weeks of gestation should be performed for all pregnant people with HIV who have an HIV RNA level greater than 1,000 copies/mL within 4 weeks of delivery or with unknown HIV RNA levels near the time of delivery, regardless of whether they are receiving antiretroviral therapy.[46] The pregnant person's CD4 cell count has no bearing on recommendations regarding cesarean delivery.
- **HIV RNA ≤1,000 copies/mL**: Insufficient data exist to indicate cesarean delivery would reduce the risk of HIV transmission for pregnant people receiving antiretroviral therapy who have detectable viremia that is less than or equal to 1,000 copies/mL within 4 weeks of delivery.[46] Accordingly, cesarean delivery is not recommended for the purpose of preventing HIV transmission for pregnant persons who have an HIV RNA level less than 1,000 copies/mL within 4 weeks of delivery.[46]
- **HIV RNA Level >1,000 copies/mL and Rupture of Membranes**: For pregnant people who have an HIV RNA level above 1,000 copies/mL within 4 weeks of delivery, but who present with rupture of membranes (or present after the onset of labor), the benefit of cesarean delivery is unknown; a meta-

analysis has found that the risk of HIV transmission increases by 2% every hour following rupture of membranes.[46]

- **HIV RNA Level ≤1,000 copies/mL and Rupture of Membranes**: For pregnant people receiving antiretroviral therapy who have an HIV RNA level less than or equal to 1,000 copies/mL within 4 weeks of delivery, the duration of membrane rupture has not been shown to correlate with risk of perinatal HIV transmission and vaginal delivery is recommended in this setting.[46,50,51,52] Complex cases should be managed in consultation with an expert in HIV perinatal transmission.

Timing for Cesarean Section Delivery

Despite the potential risk of iatrogenic prematurity, the American Congress of Obstetricians and Gynecologists (ACOG) and the Perinatal HIV Clinical Guidelines recommend performing an elective cesarean delivery for pregnant persons who have an HIV RNA level greater than 1,000 copies/mL (or unknown HIV RNA levels) at 38 weeks of gestation to avoid onset of labor.[46] If the pregnant person has an HIV RNA level less than 1,000 copies/mL and the decision is made to perform cesarean delivery for obstetric reasons, the elective cesarean delivery should be performed at the standard time for the specific obstetrical indication.[46]

Obstetric Procedures and Risk of HIV Transmission

Although limited data exist regarding the impact of obstetrical procedures on HIV transmission risk, the Perinatal HIV Clinical Guidelines recommend against the routine use of the following procedures: artificial rupture of membranes, invasive fetal scalp monitoring with scalp electrodes, and operative delivery with forceps or vacuum extractor (particularly for individuals with an HIV RNA level that is 50 copies/mL or higher or unknown HIV RNA level).[14] If, however, any of these procedures are deemed to have a clear obstetrical indication, they should be performed. The possible risk of HIV transmission from these procedures is likely lower in pregnant people who have an undetectable HIV RNA level at the time of delivery. Epidural anesthesia is considered safe during labor, regardless of the antiretroviral regimen the individual is receiving.[46] In addition, the indications for episiotomy should be the same for pregnant people with or without HIV.

Acute HIV in Pregnancy and in the Postpartum Period

Diagnosis of Acute HIV in People who are Pregnant or Breastfeeding

Persons who are pregnant or breastfeeding have an increased risk of acquiring HIV.[53,54] Acute HIV that occurs during pregnancy or while breastfeeding confers a very high risk of HIV transmission to the child because of the high HIV RNA levels in the parent's plasma, genital tract, and breastmilk that occur with acute infection. In one cohort study in New York State, investigators reported the rate of perinatal transmission was 22% among neonates born to persons who acquired HIV during pregnancy compared to 1.8% of newborns born to persons who did not acquire HIV during pregnancy.[55] Therefore, pregnant or breastfeeding individuals with symptoms of acute retroviral syndrome should undergo prompt evaluation for acute HIV infection.[21] When acute HIV is suspected during pregnancy or while breastfeeding, the evaluation should include an HIV RNA assay in combination with an HIV-1/2 antigen-antibody immunoassay.[21] If acute HIV is diagnosed during pregnancy or in a breastfeeding person, an HIV drug resistance genotype should be ordered, the newly diagnosed person should immediately start on antiretroviral therapy, and contact should be initiated with a pediatric HIV expert.

Antiretroviral Therapy for Acute HIV in Pregnancy

Given the high risk of HIV transmission to the fetus in the setting of acute maternal HIV infection, the Perinatal HIV Clinical Guidelines recommend that pregnant or breastfeeding persons with acute HIV infection should immediately begin triple antiretroviral therapy while the HIV drug resistance genotype is pending.

- **Acute HIV in Pregnancy**: For persons who are pregnant and have acute HIV (regardless of the trimester), the preferred antiretroviral regimen is dolutegravir plus either tenofovir DF-emtricitabine or tenofovir alafenamide-emtricitabine.[21] Alternatively, the pregnant person can take twice-daily ritonavir-boosted darunavir plus one of the following dual-NRTI regimens: tenofovir DF-emtricitabine, tenofovir DF plus lamivudine, tenofovir alafenamide-emtricitabine, or tenofovir alafenamide plus lamivudine.[21] This latter ritonavir-boosted darunavir regimen is indicated if the pregnant patient has been previously exposed to injectable cabotegravir for HIV PrEP. If needed, adjustments to the regimen can be made once the genotype results are known.[21]

Acute HIV in the Postpartum Period

If acute HIV is suspected in a breastfeeding parent in the postpartum period, they should receive counseling to immediately stop breastfeeding to reduce the risk of HIV transmission to the child.[21] In this situation, expert consultation should be obtained regarding the evaluation and management of the breastfeeding infant who may have been exposed to HIV.[21] If acute HIV is diagnosed in the parent, then breastfeeding should be permanently discontinued, HIV drug resistance genotype should be ordered, and the parent newly diagnosed with HIV should be promptly started on antiretroviral therapy.[21] The following regimens are recommended for the treatment of persons with acute or recent HIV in whom an HIV drug resistance genotype result is pending:[56]

- Bictegravir-tenofovir alafenamide-emtricitabine
- Dolutegravir plus (tenofovir alafenamide or tenofovir DF) plus (emtricitabine or lamivudine)
- Boosted darunavir plus (tenofovir alafenamide or tenofovir DF) plus (emtricitabine or lamivudine)

Management of the Infant Exposed to HIV

Type of Antiretroviral Management of Newborns With Perinatal HIV Exposure

Appropriate antiretroviral management of infants born to pregnant individuals with HIV plays a significant role in preventing perinatal HIV transmission. Conceptually, it is important to understand there are three different types of antiretroviral regimens used in management of newborns with perinatal HIV exposure: administration of one or more antiretroviral drugs as antiretroviral prophylaxis, three-drug combination presumptive HIV therapy, and HIV antiretroviral therapy for documented HIV infection of the newborn.[57]

Table 4. **Perinatal Guidelines: Management of Infants Born to People with HIV Infection**

Types of Antiretroviral Management of Newborns with Perinatal HIV Exposure

Category	Definition
Antiretroviral Therapy Prophylaxis	The administration of one or more antiretroviral drugs to a newborn witho risk of perinatal acquisition of HIV.
Presumptive HIV Therapy	The administration of a three-drug combination antiretroviral regimen to r acquisition of HIV. Presumptive HIV therapy is intended to be preliminary t documented to have HIV, but also serves as prophylaxis against HIV acqu to HIV *in utero*, during the birthing process, or during breastfeeding and w
HIV Therapy	The administration of a three-drug antiretroviral regimen at treatment dos newborns with documented HIV infection.

Source:

- Panel on Treatment of HIV During Pregnancy and Prevention of Perinatal Transmission. Recommendations for the Use of Antiretroviral Drugs During Pregnancy and Interventions to Reduce Perinatal HIV Transmission in the United States. Management of infants born to people with HIV: antiretroviral management of newborns with perinatal HIV exposure or HIV infection. January 31, 2023. [HIV.gov]

Neonatal Antiretroviral Medications Based on Risk of HIV Acquisition

All newborns with perinatal HIV exposure should receive antiretroviral medications in the neonatal period, with the first doses initiated as soon as possible after birth, ideally within 6 to 12 hours following delivery.[57] The regimens chosen are based on the neonate's risk of HIV acquisition. The risk of perinatal HIV transmission is estimated primarily by whether the birthing parent received antiretroviral therapy during pregnancy and their HIV RNA level within the 4 weeks prior to delivery. This information, as well as some other factors, are used to make decisions about neonatal antiretroviral intervention.[57]

Table 5. **Perinatal Guidelines: Management of Infants Born to People with HIV Infection**

Neonatal Antiretroviral Management According to Risk of HIV Infection in the Newborn

Level of Perinatal HIV Transmission Risk		Description	Neonatal Antiretroviral Management
Low Risk of Perinatal HIV Transmission	**Infants ≥37 weeks gestation when the mother—** • Is cu	Zidovudine for 2 weeks	

Level of Perinatal HIV Transmission Risk	Description	Neonatal Antiretroviral Management
rrently receiving and has received at least 10 consecutive weeks of ART during pregnancy, and • Has achieved and maintained or maintained viral suppression (defined as at least two consecutive tests with HIV RNA levels <50 copi		

Level of Perinatal HIV Transmission Risk	Description	Neonatal Antiretroviral Management
es/mL obtained at least 4 weeks apart) for the remainder of the pregnancy, and • Has HIV RNA <50 copies/mL at or after 36 weeks and within 4 weeks of delivery, and • Did not have acute HIV infection during pregnancy, and • Has repo		

Level of Perinatal HIV Transmission Risk			Description	Neonatal Antiretroviral Management
	rted good ART adherence, and adherence concerns have not been identified.			
	Infants born to mothers who do not meet the criteria above or criteria for high risk below but who have an HIV RNA <50 copies/mL at or after 36 weeks gestation	Zidovudine for 4-6 weeks		
	Premature infants (<37 weeks gestation) who are not at high risk of perinatal acquisition of HIV	Zidovudine for 4-6 weeks		
High Risk of Perinatal HIV Transmission[a,b]	Mothers who did not receive antepartum antiretroviral drugs, *or* Mothers	Presumptive HIV therapy using either: Zidovudine, lamivudine, and nevirapine		

Level of Perinatal HIV Transmission Risk			Description	Neonatal Antiretroviral Management
	who received only intrapartum antiretroviral drugs, *or* Mothers who received antepartum antiretroviral drugs but did not have viral suppression (defined as at least two consecutive tests with HIV RNA level <50 copies/mL obtained at least 4 weeks apart) within 4 weeks prior to delivery, *or* Mothers with acute or primary HIV infection during pregnancy or breastfeeding (in which case, **breastfeeding should be immediately discontinued**)[c]	(treatment dose) from birth for 2-6 weeks (if the duration of the 3-drug regimen is shorter than 6 weeks, zidovudine should be continued alone, to complete a total of 6 weeks of [d] *or* Zidovudine, lamivudine, and raltegravir administered from birth for 2-6 weeks (if the duration of the 3-drug regimen is shorter than 6 weeks, zidovudine should be continued alone, to complete a total of 6 weeks of prophylaxis[d]		
Presumed Newborn HIV Exposure	Mothers with unconfirmed HIV status who have at	Antiretroviral management as described above for		

Level of Perinatal HIV Transmission Risk			Description	Neonatal Antiretroviral Management
	least one positive HIV test at delivery or postpartum *or* Mothers whose newborns have a positive HIV antibody test	newborns with a high risk of perinatal HIV acquisition Infant antiretroviral drugs should be discontinued immediately if supplemental testing confirms that the mother does not have HIV.		
Newborn with Confirmed HIV[e]	Positive newborn HIV virologic test/nucleic acid test (NAT)	Start recommended 3-drug antiretroviral regimen using treatment doses (refer to Pediatric Antiretroviral Guidelines)		
[a] Zidovudine prophylaxis is recommended for infants born to mothers with HIV-2 monoinfection. If the mother has HIV-1 and HIV-2 infection, the infant antiretroviral regimen should be based on the determination of low or high risk of HIV-1 transmission as described in the above table. Because HIV-2 is not susceptible to nevirapine, raltegravir should be considered for infants at high risk of perinatal HIV-2 acquisition. [b] See the Intrapartum Care section for guidance on indications for scheduled cesarean delivery and intrapartum intravenous zidovudine to reduce the risk of perinatal HIV transmission for mothers with elevated viral load at				

Level of Perinatal HIV Transmission Risk	Description	Neonatal Antiretroviral Management
delivery. [c] Most Panel members would opt to administer empiric HIV therapy to infants whose mothers had acute HIV during pregnancy because of the high risk for *in utero* transmission. If acute HIV is diagnosed during breastfeeding, the mother should immediately discontinue breastfeeding. [d] The optimal duration of presumptive HIV therapy in newborns who are at a high risk for perinatal HIV acquisition is unknown. Newborns who are at high risk of HIV acquisition should receive the zidovudine component of the three-drug presumptive HIV therapy regimen for 6 weeks. The other two antiretrovirals (lamivudine and nevirapine or lamivudine plus raltegravir) may be administered for 2 to 6 weeks; the recommended duration for treatment with three antiretroviral varies depending on infant HIV NAT results, maternal viral load at the time of delivery, and additional risk factors for HIV transmission including breastfeeding. Consultation with an expert in pediatric HIV is recommended when selecting a therapy duration because this decision should be based on case-specific risk factors and interim infant HIV NAT results. [e] Infant antiretroviral therapy should be initiated without waiting for the results of confirmatory HIV NAT testing, given the low likelihood of a false-positive HIV NAT. However, the specimen for confirmatory HIV testing should be obtained prior to antiretroviral initiation. Note: Antiretroviral drugs should be initiated as close to the time of birth as possible, preferably within 6 hours of delivery. Key to Acronyms: NAT = nucleic acid test		

Source:

- Panel on Treatment of HIV During Pregnancy and Prevention of Perinatal Transmission. Recommendations for the Use of Antiretroviral Drugs During Pregnancy and Interventions to Reduce Perinatal HIV Transmission in the United States. Management of infants born to people with HIV: antiretroviral management of newborns with perinatal HIV exposure or HIV infection. January 31, 2023. [HIV.gov]

Dosing of Antiretroviral Medications in Neonates

As outlined in the following table, the dosing for all antiretroviral medications in newborns should be based on weight and gestational age.[57]

Table 6. **Perinatal Guidelines: Management of Infants Born to People with HIV Infection**

Antiretroviral Dosing Recommendations for Newborns

Drug	Drug Doses by Gestation Age at Birth
Zidovudine Note: For newborns unable to tolerate oral agents, the IV dose is 75% of the oral dose while maintaining the same dosing interval.	**≥35 Weeks Gestation at Birth** *Birth to Age 4 Weeks:* • Zidovudine 4 mg/kg/dose orally twice daily or alternative simplified weight-band dosing (see below) *Age >4 weeks:* • Zidovudine 12 mg/kg per dose orally twice daily; only make this dose increase for infants with confirmed HIV infection **Simplified Weight-Band Dosing for Newborns Aged ≥35 Weeks Gestation from Birth to 4 Weeks** Weight Band — Volume of Zidovudine 10 mg/mL Oral Syrup Twice Daily 2 to <3 kg — 1 mL 3 to <4 kg — 1.5 mL 4 to <5 kg — 2 mL
	≥30 to <35 Weeks Gestation at Birth *Birth to Age 2 Weeks:* • Zidovudine 2 mg/kg per dose orally twice daily *Age 2 Weeks to 6 to 8 Weeks:* • Zidovudine 3 mg/kg per dose

Drug	Drug Doses by Gestation Age at Birth
	orally twice daily *Age >6 to 8 Weeks:* • Zidovudine 12 mg/kg per dose orally twice daily; make this dose increase only for infants with confirmed HIV infection
	<30 Weeks Gestation at Birth *Birth to Age 4 Weeks:* • Zidovudine 2 mg/kg per dose orally twice daily *Age 4 to 8 to 10 Weeks:* • Zidovudine 3 mg/kg per dose orally twice daily *Age >8 to 10 Weeks:* • Zidovudine 12 mg/kg per dose orally twice daily; only make this dose increase for infants with confirmed HIV
Abacavir Provided HLA-B5701 allele testing is negative Note: abacavir is not approved by the FDA for use in neonates and infants aged <1 month. However, dosing recommendations have been modeled using PK simulation. Because of abacavir-associated hypersensitivity, negative testing for HLA-B5701 allele should be confirmed prior to administration of abacavir.	**≥37 Weeks' Gestation at Birth** *Birth to 1 Month:* • Abacavir 2 mg/kg per dose orally twice daily *Age 1 Month to <3 Months:* • Abacavir 4 mg/kg per dose orally twice daily
Lamivudine	**≥32 Weeks' Gestation at Birth** *Birth to Age 4 Weeks:* • Lamivudine 2 mg/kg/dose orally twice daily *Age >4 Weeks:* • Lamivudine 4 mg/kg per dose orally twice daily

Drug	Drug Doses by Gestation Age at Birth
Nevirapine	**≥37 Weeks Gestation at Birth:** *Birth to Age 4 Weeks:* • Nevirapine 6 mg/kg per dose orally twice daily *Age >4 Weeks:* • Nevirapine 200 mg/m^2 of body surface area (BSA) per dose orally twice daily; only make this dose increase for infants with confirmed HIV infection. **Note**: Nevirapine dose adjustment at 4 weeks of age is optional for empiric HIV therapy
	≥34 to <37 Weeks Gestation at Birth *Birth to Age 1 Week:* • Nevirapine 4 mg/kg per dose orally twice daily *Age 1 to 4 Weeks:* • Nevirapine 6 mg/kg per dose orally twice daily *Age >4 Weeks:* • Nevirapine 200 mg/m^2 of BSA per dose orally twice daily; only make this dose increase for infants with confirmed HIV infection.
	≥32 to <34 Weeks' Gestation at Birth *Birth to Age 2 Weeks* • Nevirapine 2 mg/kg per dose orally twice daily *Age 2 to 4 Weeks* • Nevirapine 4 mg/kg per dose orally twice daily *Age 4 to 6 Weeks*

<table>
<tr><th>Drug</th><th colspan="2">Drug Doses by Gestation Age at Birth</th></tr>
<tr><td></td><td colspan="2">• Nevirapine 6 mg/kg per dose orally twice daily

Age >6 Weeks

• Nevirapine 200 mg/m^2 BSA per dose orally twice daily; only make this dose increase for infants with confirmed HIV infection.</td></tr>
<tr><td>Raltegravir

Note: If the mother has taken raltegravir 2 to 24 hours prior to delivery, the neonate’s first dose of raltegravir should be delayed until 24 to 48 hours after birth; additional antiretroviral drugs should be started as soon as possible.</td><td colspan="2">≥37 Weeks Gestation at Birth and Weighing ≥2 kg

Birth to Age 6 Weeks:

<table>
<tr><td>Body Weight</td><td>Volume (Dose) of Raltegravir 10 mg/mL Suspension</td></tr>
<tr><td>Birth to 1 Week: Once Daily Dosing</td><td>Approximately 1.5 mg/kg per dose</td></tr>
<tr><td>2 to <3 kg</td><td>0.4 mL (4 mg) once daily</td></tr>
<tr><td>3 to <4 kg</td><td>0.5 mL (5 mg) once daily</td></tr>
<tr><td>4 to <5 kg</td><td>0.7 mL (7 mg) once daily</td></tr>
<tr><td>1 to 4 Weeks: Twice Daily Dosing</td><td>Approximately 3 mg/kg per dose</td></tr>
<tr><td>2 to <3 kg</td><td>0.8 mL (8 mg) twice daily</td></tr>
<tr><td>3 to <4 kg</td><td>1 mL (10 mg) twice daily</td></tr>
<tr><td>4 to <5 kg</td><td>1.5 mL (15 mg) twice daily</td></tr>
<tr><td>4 to 6 Weeks: Twice Daily Dosing</td><td>Approximately 6 mg/kg per dose</td></tr>
<tr><td>3 to <4 kg</td><td>2.5 mL (25 mg) twice daily</td></tr>
<tr><td>4 to <6 kg</td><td>3 mL (30 mg) twice daily</td></tr>
<tr><td>6 to <8 kg</td><td>4 mL (40 mg) twice daily</td></tr>
</table></td></tr>
</table>

Source:

- Panel on Treatment of HIV During Pregnancy and Prevention of Perinatal Transmission. Recommendations for the Use of Antiretroviral Drugs During Pregnancy and Interventions to Reduce Perinatal HIV Transmission in the United States. Management of infants born to people with HIV: antiretroviral management of newborns with perinatal HIV exposure or HIV infection. January 31, 2023. [HIV.gov]

Additional Initial Care of the Neonate Exposed to HIV

In addition to providing antiretroviral management for all neonates born to people with HIV, other aspects of care need to be addressed. Following delivery, infants born to persons with HIV require hematological monitoring in addition to routine infant care; there is no evidence that changes in routine bathing practices or timing of circumcision are required.[58] A complete blood count (CBC) and differential should be performed at birth prior to the initiation of infant antiretroviral drug prophylaxis and again at 4 weeks of age since anemia is the primary complication of zidovudine.[58] In addition, some experts advise checking serum chemistry and liver function tests depending on which antiretroviral therapies the infant was exposed to *in utero*.

Evaluating the Infant for HIV

Initial HIV testing in infants should be performed using an HIV nucleic acid test (NAT)—with either an HIV DNA or HIV RNA assay.[59] Routine HIV antigen-antibody testing should not be used to diagnose HIV in newborns since HIV antibody crosses the placenta and can persist through 18 months of age, and HIV p24 antigen is much less sensitive than HIV NAT.[59] For the criteria listed below for presumptive and definitive exclusion of infant HIV infection, the child should not have any laboratory or clinical indicator that may suggest HIV infection (e.g., a low CD4 cell count or any clinical findings).

- **Recommended Testing**: The recommendations schedule for HIV NAT in infants with perinatal HIV exposure depends on whether the risk of HIV acquisition is considered low or high. Infants with a low risk of perinatal HIV exposure should have HIV NAT performed at 14 to 21 days of life, 1 to 2 months of age, and 4 to 6 months of age; infants considered to have high-risk for perinatal acquisition of HIV should have additional HIV NATs performed at birth, 14 to 21 days of life, 1 to 2 months of age, 2 to 3 months of age, and 4 to 6 months of age (Figure 6).[59]
- **Recommended Testing for Breastfed Infants**: Infants with perinatal exposure who are being breastfed should have HIV NAT obtained at birth and after birth at ages 14-21 days, 1 to 2 months, 2 to 4 months, and at 4 to 6 months.[59] If breastfeeding continues after the infant is 6 months of age, NAT testing should be continued and performed every 3 months.[59] Further, HIV NAT should be obtained at 6 weeks, 3 months, and 6 months after cessation of breastfeeding, regardless of the age at when breastfeeding stopped.[59]
- **Testing for Non-B Virus Subtypes**: Due to the increasing proportion of foreign-born children with HIV in the United States, testing for non-B viral subtypes is now recommended and HIV NAT should be performed in a laboratory that will detect non-B HIV subtypes if the birthing parent is known to have or suspected to have non-B subtype HIV.[58,59]
- **Antibody Testing After 12 Months of Age**: A negative HIV antibody test at 12 to 18 months of age provides further confirmation of the child's HIV-negative status, and some experts perform antibody testing at this age in infants with prior negative HIV NAT.[58,59]
- **Presumptive Exclusion of HIV**: In non-breastfed infants, HIV can be presumptively excluded when any of the following criteria are met: (1) two or more negative HIV NAATs (one at age 14 days or older and the other at age 1 month or older), (2) one negative HIV NAAT at age 8 weeks or older, or (3) one negative HIV antibody test at age 6 months or older.[59]
- **Definitive Exclusion of HIV**: Definitive exclusion of HIV in non-breastfed infants can be based on either (1) two or more negative HIV NAATs, with one test performed at age 1 month or older and the other test at age 4 months or older, or (2) two negative HIV antibody tests obtained at 6 months of age or older.[59]
- **Indeterminate HIV Status**: This refers to an HIV-exposed child aged younger than 18 months of age who was born to a person with HIV, and the child does not meet the criteria for having HIV or for not having contracted HIV.[59]

Pneumocystis Pneumonia Prophylaxis for the Infant

At 4 to 6 weeks of age, all infants born to individuals with HIV should begin prophylaxis for *Pneumocystis* pneumonia unless HIV has been presumptively excluded with virologic testing.[58] The preferred agent for *Pneumocystis* pneumonia prophylaxis in neonates is trimethoprim-sulfamethoxazole.[60] The prophylaxis for *Pneumocystis* pneumonia can be discontinued if the HIV diagnosis in the child is presumptively or definitively excluded.

Long-term Follow-up of Infants Born to Persons with HIV

Although the long-term effects of *in utero* exposure to antiretroviral therapy and to HIV itself (even if the infant was not infected) are not fully known, available data suggest that antiretroviral therapy taken during pregnancy does not cause subsequent long-term risk of neoplasia or organ toxicities to these children.[61,62,63,64,65] Nevertheless, further study is needed since newer antiretroviral agents continue to be used in pregnant people with HIV. Multiple studies and surveillance projects at the state and national level are ongoing. The Perinatal HIV Clinical Guidelines recommend that any children with *in utero*/perinatal exposure to antiretroviral therapy who develop organ system abnormalities, particularly neurological or cardiac, should be evaluated for mitochondrial dysfunction, and follow-up of children exposed to antiretroviral medications should continue lifelong due to concern for potential carcinogenicity of nucleoside reverse transcriptase inhibitor drugs.[64] In the long-term medical record of the child, the medical provider should document specific information related to the child's exposure to antiretroviral medications *in utero* and in the postpartum period.

Postpartum Follow-Up for Women with HIV

Infant Feeding

All pregnant individuals should receive counseling on breastfeeding.[66] The options and recommendations in the Perinatal HIV Clinical Guidelines for breastfeeding and infant feeding, as outlined below, should be informed by whether the individual with HIV giving birth to the infant is taking antiretroviral therapy and whether this person with HIV has suppressed plasma HIV RNA levels.[57,66]

- **Birth Parent Does Not Have Virologic Suppression**: In general, for individuals with HIV who give birth and who are not on antiretrovirals (or are taking antiretrovirals without virologic suppression during pregnancy), breastfeeding is not recommended. These individuals should be given information on formula or banked pasteurized donor human milk in order to mitigate risk of HIV transmission to the infant from breast milk.
- **Birth Parent with Suppressed HIV RNA Levels**: For persons with HIV who give birth and are taking antiretroviral therapy and have undetectable plasma HIV RNA levels, studies in resource-limited environments have shown the risk of HIV transmission via breastfeeding in the setting of virologic suppression is quite low (less than 1%), albeit not zero.[66,67,68] For individuals with sustained viral suppression on antiretroviral therapy, the Perinatal HIV Clinical Guidelines recommend the patient and medical provider engage in informed, shared decision-making regarding the risk-benefit ratio of breastfeeding. Regardless of whether the patient chooses to breastfeed or formula feed, their health care provider should support the decision. For those persons with sustained viral suppression who choose to breastfeed, some experts would recommend one of the following three options for the newborn: (1) extending the duration of zidovudine prophylaxis from 2 weeks to 4–6 weeks, (2) use nevirapine prophylaxis for 6 weeks, or (3) extend the duration of nevirapine throughout breastfeeding.[57]

Postpartum Antiretroviral Therapy

Pregnant people with HIV who receive antiretroviral therapy during pregnancy should continue to receive antiretroviral therapy after delivery, both for their own health and to prevent sexual transmission of HIV to their sex partners.[69] The HPTN 052 study, among others, has shown that antiretroviral therapy markedly reduces the risk of sexual HIV transmission to uninfected partners in HIV-serodifferent couples.[70] Taking antiretroviral therapy in the postpartum period may be very challenging due to the birth parent’s fatigue, psychosocial stress, and demands and responsibilities of taking care of a newborn. Indeed, multiple studies have shown that antiretroviral adherence and viral suppression decline after persons with HIV give birth.[71,72,73] All people with HIV who give birth should undergo screening for postpartum depression, since depression in the postpartum period is common and may negatively impact antiretroviral adherence.[72] Medical providers should make sure that the individual recently giving birth and their infant receive any prescribed antiretroviral medications prior to hospital discharge.[69]

Summary Points

- All pregnant people should undergo screening for HIV, including individuals who present in labor without prior testing during the pregnancy.
- For pregnant people with HIV, perinatal HIV transmission rates of less than 1% can be achieved with a comprehensive, multipronged approach that includes suppressive combination antiretroviral therapy during pregnancy, use of elective cesarean section (when indicated), intravenous zidovudine during labor (when indicated), and postnatal infant antiretroviral prophylaxis. The risk of perinatal HIV transmission correlates with HIV RNA levels in the pregnant person, but there is no HIV RNA level cutoff at which transmission cannot occur.
- All persons diagnosed with HIV during pregnancy (and people with known HIV who become pregnant and are not receiving antiretroviral therapy) should promptly start combination antiretroviral therapy and continue antiretroviral therapy throughout the pregnancy.
- The preferred initial antiretroviral regimens consist of dual NRTIs (abacavir-lamivudine; tenofovir alafenamide plus either emtricitabine or lamivudine; or tenofovir DF plus either emtricitabine or lamivudine) in combination with an anchor drug—either dolutegravir or ritonavir-boosted darunavir.
- In most circumstances, persons with established HIV who become pregnant and are already taking fully suppressive antiretroviral therapy should continue the same regimen. Consideration should be given to switching from any 2-drug regimen or any regimen that contains cobicistat.
- Laboratory monitoring of HIV RNA levels should occur every 3 months during pregnancy to evaluate for viral suppression; more frequent HIV RNA monitoring (every 1 to 2 months) may be needed depending on the antiretroviral regimen taken during pregnancy. Obtaining an HIV RNA level at 34 to 36 weeks of gestation is important in making decisions about delivery and newborn management.
- Pregnant individuals who present late to prenatal care should start on antiretroviral therapy immediately, and additional interventions, including intravenous zidovudine and elective cesarean section, may be recommended to help decrease the risk of perinatal transmission.
- For pregnant people with HIV, cesarean section and intravenous zidovudine during labor are indicated if the HIV RNA level is greater than 1,000 copies/mL within the 4 weeks prior to delivery (or if they have an unknown HIV RNA level within the 4 weeks prior to delivery).
- Evaluation for HIV infection of infants younger than 18 months of age who are born to individuals with HIV requires use of HIV nucleic acid amplification tests; a positive HIV antibody test is not reliable since HIV antibodies cross the placenta and often persist in the infant for at least 18 months. Infants born to persons with HIV should receive antiretroviral management based on the infant's risk of having acquired HIV.
- People with untreated HIV who give birth are advised to avoid breastfeeding due to the risk of transmitting HIV to their infant through colostrum and breastmilk and the availability of affordable, safe, and acceptable feeding alternatives. Postpartum individuals who have undetectable HIV RNA levels on stable antiretroviral therapy should have a discussion with their healthcare provider regarding the risks and benefits of breastfeeding.

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- Tubiana R, Le Chenadec J, Rouzioux C, et al. Factors associated with mother-to-child transmission of HIV-1 despite a maternal viral load Tuomala RE, Shapiro DE, Mofenson LM, et al. Antiretroviral therapy during pregnancy and the risk of an adverse outcome. N Engl J Med. 2002;346:1863-70.Van de Perre P, Simonon A, Msellati P, et al. Postnatal transmission of human immunodeficiency virus type 1 from mother to infant. A prospective cohort study in Kigali, Rwanda. N Engl J Med. 1991;325:593-8.Wertz J, Cesario J, Sackrison J, Kim S, Dola C. Acute HIV Infection in Pregnancy: the case for third trimester rescreening. Case Rep Infect Dis. 2011;2011:340817.

Figures

Figure 1 Perinatal HIV Infections in the United States, 2016-2020

Source: Centers for Disease Control and Prevention. Diagnoses of HIV infection in the United States and dependent areas, 2018 (Preliminary). HIV Surveillance Report, 2020; vol. 33:1-143. Published May 2022.

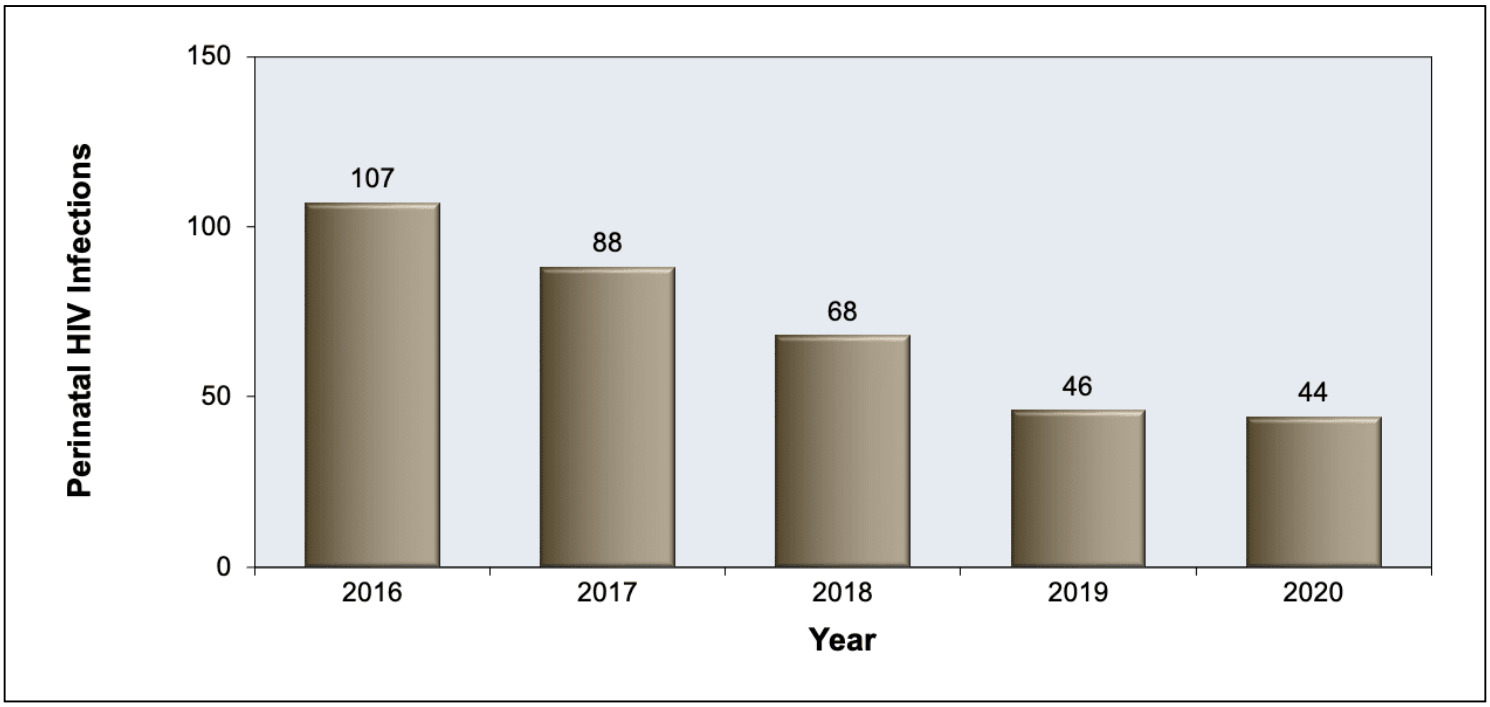

Figure 2 Pediatric AIDS Clinical Trials Group Protocol 076

Source: Connor EM, Sperling RS, Gelber R, et al. Reduction of maternal-infant transmission of human immunodeficiency virus type 1 with zidovudine treatment. Pediatric AIDS Clinical Trials Group Protocol 076 Study Group. N Engl J Med. 1994;331:1173-80.

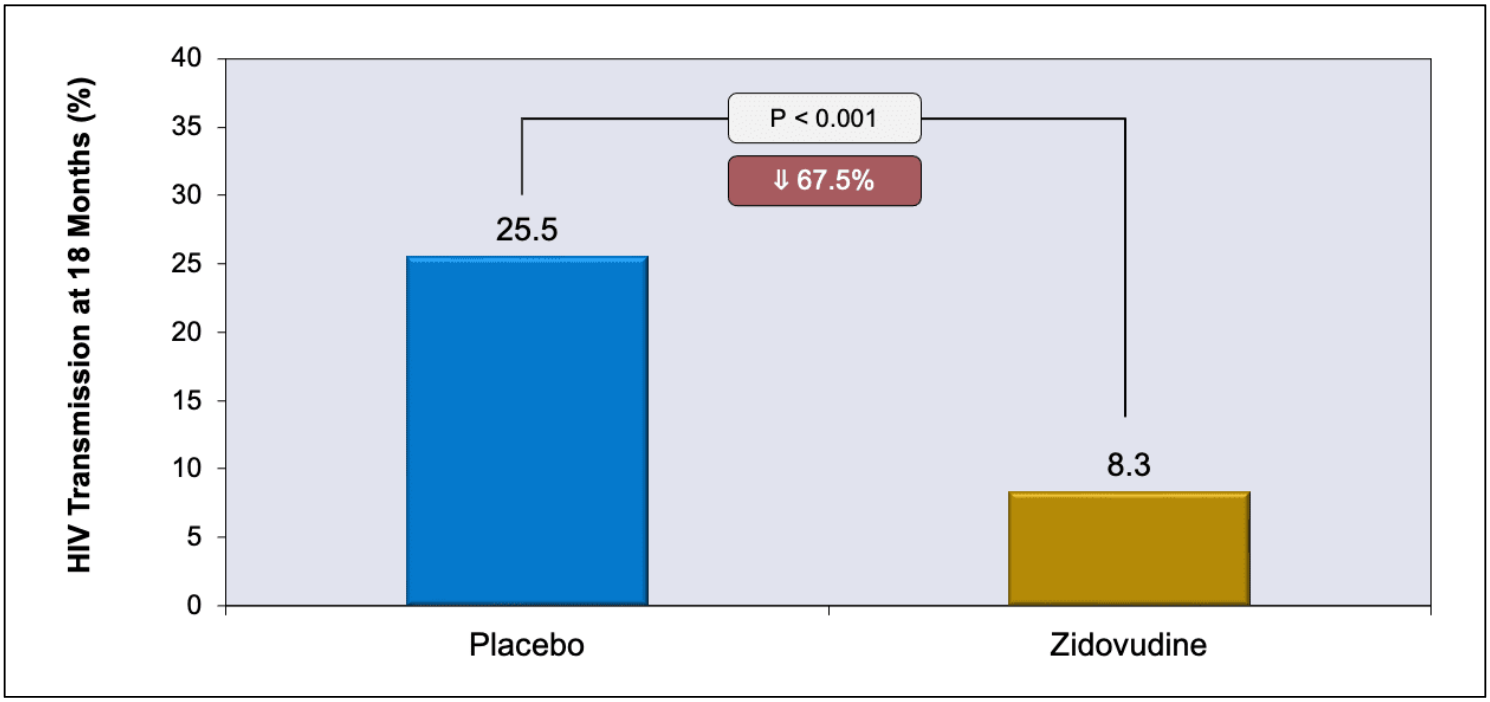

Figure 3 Timing of Abbreviated Regimens of Zidovudine and Risk of Perinatal HIV Transmission

Source: Wade NA, Birkhead GS, Warren BL, et al. Abbreviated regimens of zidovudine prophylaxis and perinatal transmission of the human immunodeficiency virus. N Engl J Med. 1998;339:1409-14.

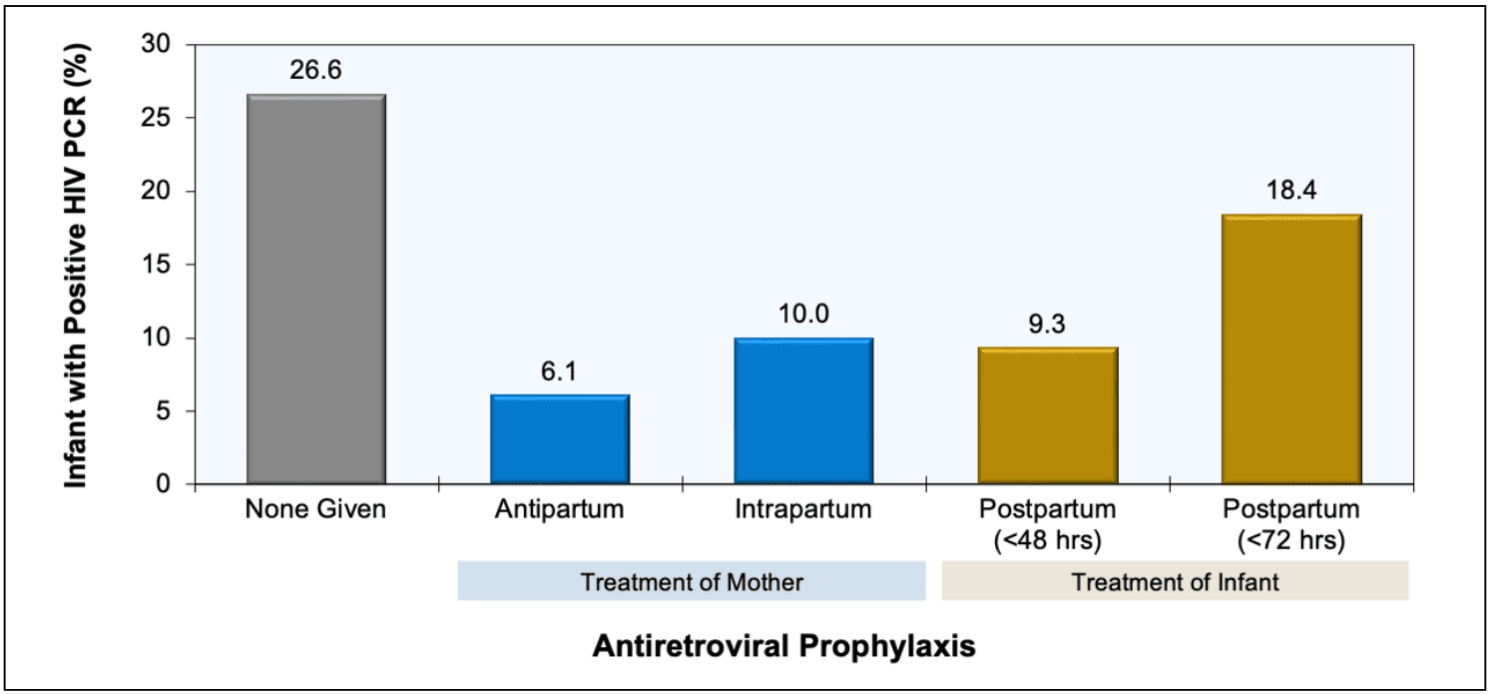

Figure 4 Antenatal Antiretroviral Therapy and Impact on Perinatal HIV Transmission

Source: Cooper ER, Charurat M, Mofenson L, et al. Combination antiretroviral strategies for the treatment of pregnant HIV-1 pregnant women and prevention of perinatal HIV-1 transmission. J Acquir Immune Defic Syndr. 2002;29:484-94.

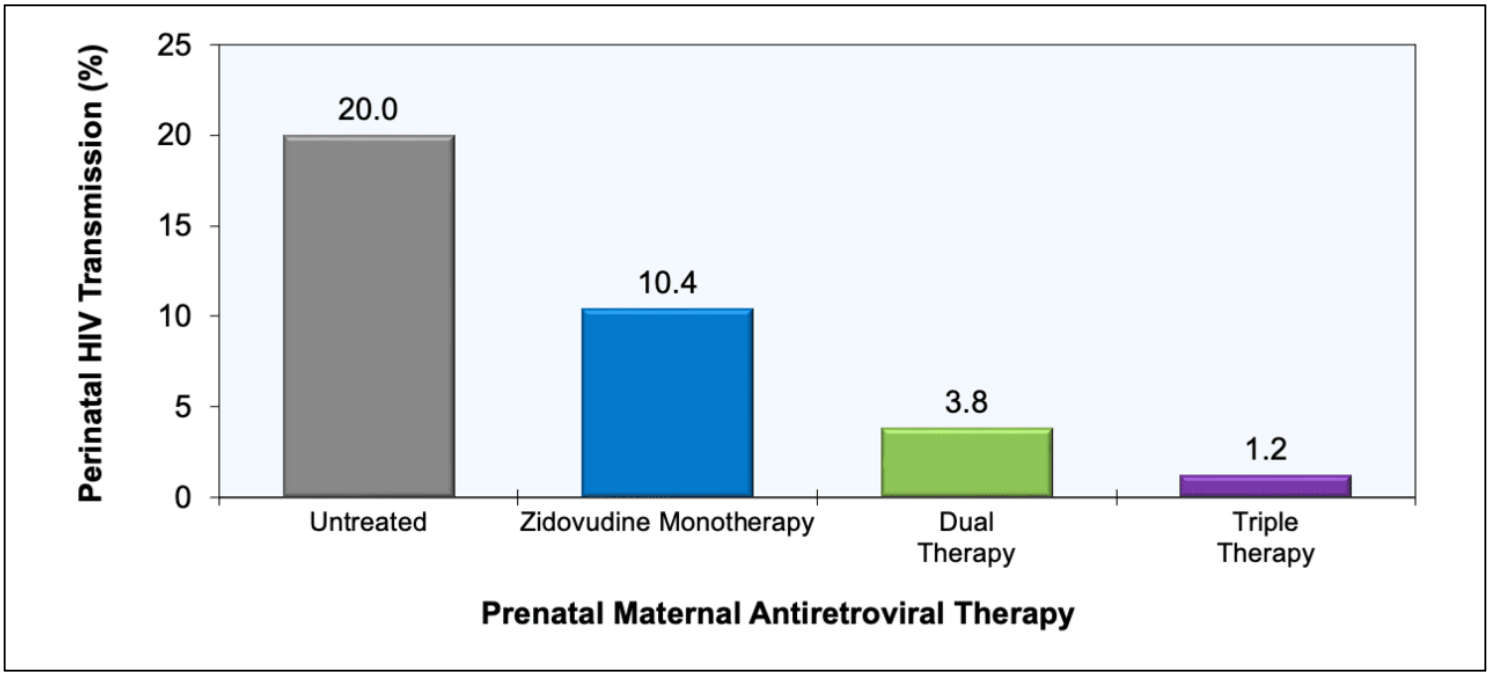

Figure 5 Perinatal HIV-1 Transmission Rates According to HIV RNA Level at Delivery: The ANRS French Perinatal Cohort (1997–2004)

In the ANRS French Perinatal Cohort study, investigators evaluated the risk of mother-to-child HIV transmission in 5,271 mothers who received antiretroviral therapy during pregnancy. This graph shows the HIV transmission rate based on the HIV RNA level of the mother at delivery and the time of gestation when the baby was born.

Source: Warszawski J, Tubiana R, Le Chenadec J, et al. Mother-to-child HIV transmission despite antiretroviral therapy in the ANRS French Perinatal Cohort. AIDS. 2008;22:289-99.

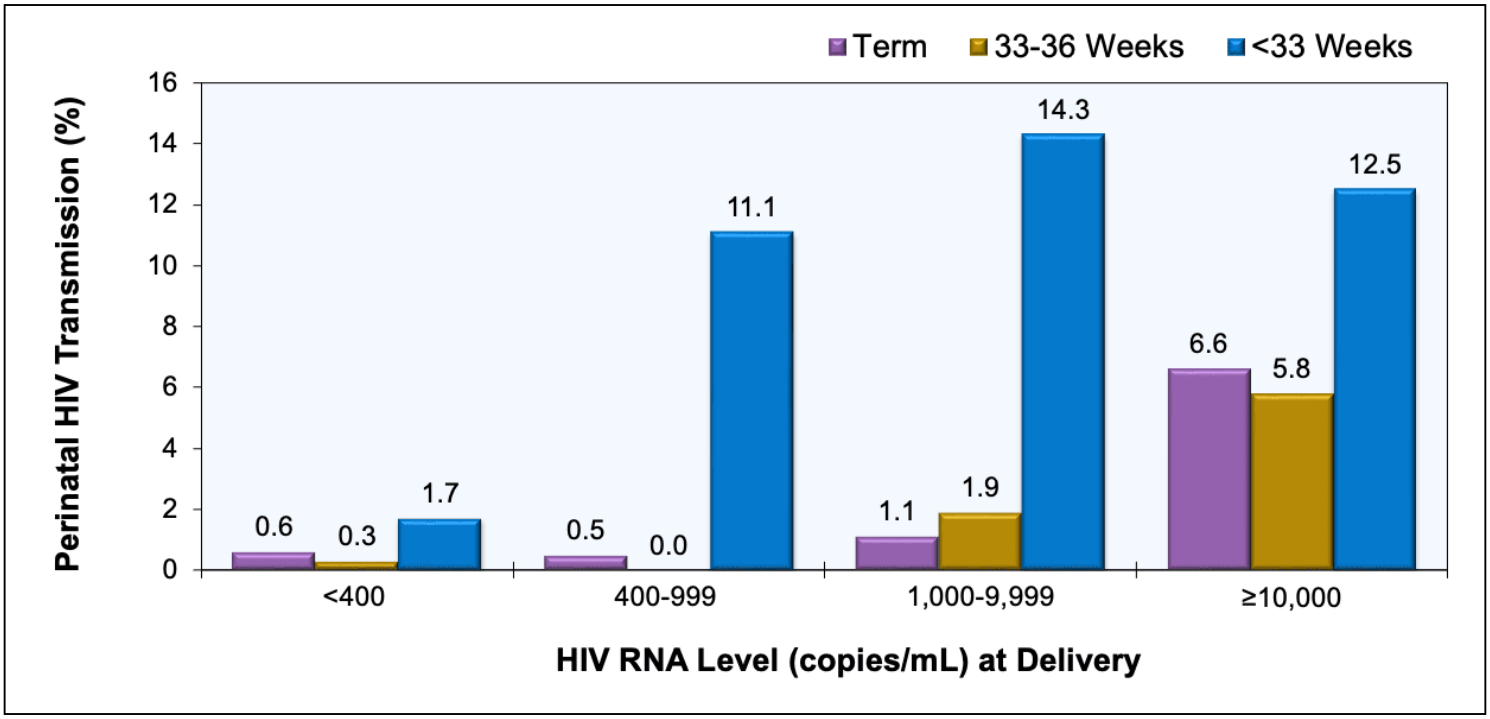

Figure 6 Recommended Virologic Testing Schedules for Infants Exposed to HIV by Perinatal HIV Transmission Risk

Abbreviations: NAT = nucleic acid test
For low-risk infants the last test may be timed to occur at least 2 weeks after stopping antiretroviral therapy
*For high-risk infants, additional virologic diagnostic testing is recommended at birth and 2 to 6 weeks after cessation of antiretroviral prophylaxis (i.e., at 8 to 12 weeks of life).
"Low Risk" refers to infants born to persons with HIV who received standard antiretroviral therapy during pregnancy and achieved sustained suppression of HIV RNA levels and no concerns exist regarding antiretroviral adherence during the pregnancy.
"Higher Risk" infants are those born to persons with HIV who did not receive prenatal care, did not receive antepartum or intrapartum antiretroviral therapy, received only intrapartum antiretroviral medications, initiated antiretroviral therapy late in pregnancy (late second or third trimester), were diagnosed with acute HIV infection during pregnancy, or had detectable HIV viral loads close to the time of delivery.

Source: Panel on Treatment of HIV During Pregnancy and Prevention of Perinatal Transmission. Recommendations for the Use of Antiretroviral Drugs During Pregnancy and Interventions to Reduce Perinatal HIV Transmission in the United States. Management of infants born to people with HIV: initial postnatal management of the neonate exposed to HIV. December 30, 2021.

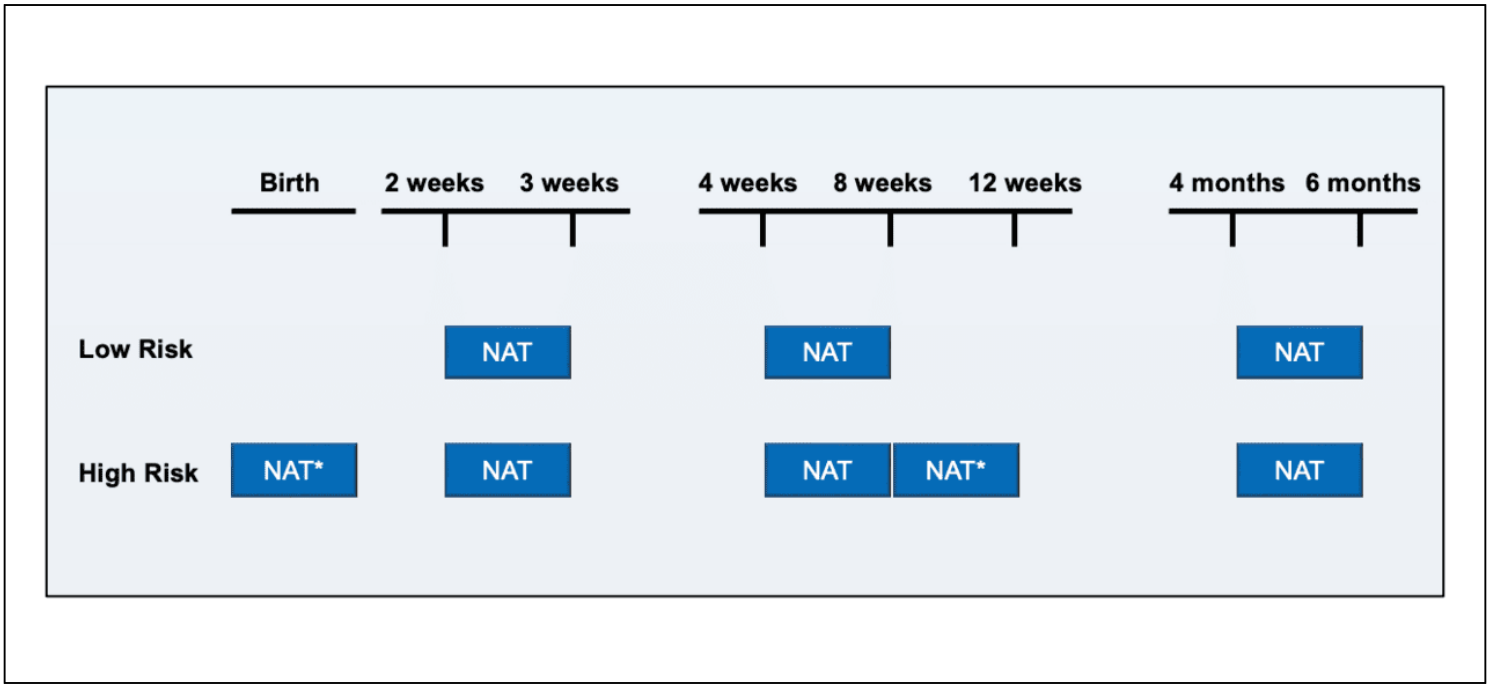

Table 1. **Perinatal Guidelines: Recommendations for Use of Antiretroviral Drugs During Pregnancy**

***Preferred* Initial Regimens in Pregnancy**

Drugs or drug combinations are designated as *Preferred* for therapy during pregnancy when clinical trial data in adults have demonstrated efficacy and durability with acceptable toxicity and ease of use, and pregnancy-specific pharmacokinetic data are available to guide dosing. In addition, the available data must suggest a favorable risk-benefit balance for the drug or drug combination compared to other antiretroviral drug options; the assessment of risks and benefits should incorporate outcomes for maternal, pregnancy, fetal, and infant outcomes. Some *Preferred* drugs or regimens may have minimal toxicity or teratogenicity risks that are offset by other advantages for people with HIV who are pregnant or who are trying to conceive. Therefore, it is important to read all the information on each drug in the *Perinatal Guidelines* before administering any of these medications to patients.

***Preferred* Dual-NRTI Backbones**	**Advantages**	**Disadvantages**
Abacavir-lamivudine	• Once-daily dosing • Available as a fixed-dose combination • Well-tolerated during pregnancy • Reassuring PK data during pregnancy • Available as fixed-dose combination. Can be administered once daily.	• Requires HLA Abacavir sho who test posi of the risk of hypersensitiv education ab reactions. • Not able to b virus/HIV con • Abacavir lam atazanavir-rit recommende >100,000 co • Abacavir is n regimens for (acute or rec requires HLA- When results not available, tenofovir alaf abacavir will ART.
Tenofovir alafenamide-emtricitabine *or* Tenofovir alafenamide plus lamivudine	• Once-daily dosing • Available as a fixed-dose combination • Reassuring PK data and extensive use during pregnancy; no dose adjustment required in pregnancy • Activity against hepatitis B virus • Minimal toxicity compared to zidovudine-lamivudine • When combined with dolutegravir, the efficacy and toxicity of tenofovir alafenamide-emtricitabine and tenofovir DF-emtricitabine for treatment of pregnant	• When combin tenofovir alaf associated wi emergent ob women comp emtricitabine weight gain i beneficial, as column.)

	patients are similar, but tenofovir alafenamide-emtricitabine is associated with fewer adverse birth outcomes and less risk of insufficient weight gain in pregnancy.	
	• Once-daily dosing • Available as a fixed-dose combination • Reassuring PK data during pregnancy; no dose adjustment required in pregnancy • Activity against hepatitis B virus • When combined with dolutegravir, the efficacy and toxicity of tenofovir alafenamide-emtricitabine and tenofovir DF-emtricitabine for treatment of pregnant patients are similar.	
Tenofovir DF-emtricitabine *or* Tenofovir DF plus lamivudine		• Potential con early-life grov tenofovir DF, are reassurin • Tenofovir DF thus, tenofov combinations in patients wi
***Preferred* INSTI Regimens**	**Advantages**	**Disadvantages**
Dolutegravir-abacavir-lamivudine *or* Dolutegravir plus a *Preferred* Dual-NRTI Backbone	• Once-daily dosing • Dolutegravir-abacavir-lamivudine is available as a fixed-dose combination. • Sufficient data about PK, efficacy, and safety of dolutegravir in pregnancy • High rates of viral suppression • Dose adjustments during pregnancy are not needed. • May be particularly useful when drug interactions or the potential for preterm delivery with a PI-based regimen are a concern. • Dolutegravir has been shown to rapidly decrease viral load in ARV-naive pregnant women who present to care later in pregnancy. In nonpregnant adults, dolutegravir is associated with lower rates of INSTI resistance than raltegravir, and dolutegravir allows for once-daily dosing; for these reasons, dolutegravir is particularly useful for pregnant people presenting late in pregnancy. • Dolutegravir with a NRTI backbone of tenofovir alafenamide or Tenofovir DF with lamivudine or emtricitabine is the *Preferred* regimen for initial treatment in people with early (acute or recent) HIV infection in people without a history of cabotegravir exposure for PrEP.	• Potential con gain with dolu • Dolutegravir- requires HLA- (see abacavir • Specific timin recommenda taken with ca prenatal vitar • Dolutegravir treatment in recent) HIV ir cabotegravir concerns abo mutations; da ritonavir is *Pr*
***Preferred* PI Regimens**	**Advantages**	**Disadvantages**
Darunavir boosted with ritonavir plus a *Preferred* Dual-NRTI Backbone	• When a PI-based regimen is indicated, atazanavir or darunavir is recommended over lopinavir-ritonavir. • Darunavir boosted with ritonavir plus an NRTI backbone of tenofovir alafenamide or tenofovir DF with lamivudine or emtricitabine is the *Preferred* regimen for initial treatment in people	• Not available • Requires twic pregnancy • Requires adm • PIs may incre

	with early (acute or recent) HIV infection and a history of cabotegravir exposure for HIV PrEP.	

Abbreviations: NRTI = nucleoside reverse transcriptase inhibitor; INSTI = integrase strand transfer inhibitor; PI = p antiretroviral; PK = pharmacokinetics; PrEP = preexposure prophylaxis

Source:

- Panel on Treatment of HIV During Pregnancy and Prevention of Perinatal Transmission. Recommendations for the Use of Antiretroviral Drugs During Pregnancy and Interventions to Reduce Perinatal HIV Transmission in the United States. Antepartum Care. Recommendations for use of antiretroviral drugs during pregnancy. Table 6. What to start: initial antiretroviral regimens during pregnancy for people who are antiretroviral-naive. January 31, 2023. [HIV.gov]

Table 2. **Perinatal Guidelines: Recommendations for Use of Antiretroviral Drugs During Pregnancy**

***Alternative* Initial Regimens in Pregnancy**

Drugs or drug combinations are designated as *Alternative* options for therapy during pregnancy when clinical trial data in adults show efficacy and the data in pregnant individuals are generally favorable, but limited. Most *Alternative* drugs or regimens are associated with more PK, dosing, tolerability, formulation, administration, or interaction concerns than those in the *Preferred* category, but they are acceptable for use in pregnancy. Some *Alternative* drugs or regimens may have known toxicity or teratogenicity risks that are offset by other advantages for people with HIV who are pregnant or who are trying to conceive. Therefore, it is important to read all the information on each drug in the *Perinatal Guidelines* before administering any of these medications to patients.

***Alternative* INSTI Regimens**	**Advantages**	**Disadvantages**
Raltegravir plus a *Preferred* Dual-NRTI Backbone	• Reassuring safety data • Like dolutegravir, raltegravir may be particularly useful when drug interactions or the potential for preterm delivery with PI-based regimens are a concern. • PK data are available for raltegravir in pregnancy when using the twice-daily formulation (400 mg twice daily). • Like dolutegravir, raltegravir has been shown to rapidly decrease viral load in ARV-naive pregnant women who present to care later in pregnancy. In nonpregnant adults, dolutegravir is associated with lower rates of INSTI resistance than raltegravir, and dolutegravir permits once-daily dosing; for these reasons, dolutegravir is *Preferred*& and raltegravir is *Alternative* for use during pregnancy.	• Twice-daily dosin due to low drug le during pregnancy • Not available as a • Lower barrier to r this reason, ralteg pregnancy • PK data are not a mg (2 times; 600 formulation (ralte • Specific timing ar apply if raltegravi (e.g., in prenatal
***Alternative* PI Regimens**	**Advantages**	**Disadvantages**
Atazanavir boosted with ritonavir plus a *Preferred* Dual-NRTI Backbone	• Once-daily dosing • Extensive experience during pregnancy	• Not available as a • Associated with in bilirubin levels, w the risk of neonat clinically significa kernicterus repor monitoring is reco • Requires increase trimester • Has been associa reductions in lang and late language • PIs may increase • Do not use with p • Requires consider H2 blockers, whic pregnancy.
***Alternative* NRTI Regimens**	**Advantages**	**Disadvantages**
Zidovudine-lamivudine	• Available as a fixed-dose combination	• Requires twice-da

	• Significant experience during pregnancy	• Associated with h including nausea, maternal and neo • Other regimens h greater efficacy a
***Alternative* NNRTI Regimens**	**Advantages**	**Disadvantages**
Efavirenz-tenofovir DF-emtricitabine *or* Efavirenz-tenofovir DF-lamivudine *or* Efavirenz plus a *Preferred* Dual-NRTI Backbone	• Once-daily dosing • Available as a fixed-dose combination • Extensive experience in pregnancy • Not associated with increased risk of neural tube defect or other congenital anomalies in human studies (although cautionary text based on animal studies remains in the package insert. • No dose changes are required during pregnancy. • Useful for patients who require treatment with drugs that have significant interactions with *Preferred* agents or who need the convenience of a coformulated, single-tablet, once-daily regimen and are not eligible for dolutegravir.	• Overall higher rat some *Preferred* d • Requires enhance suicidality • Increased risk of observed with Efa versus dolutegrav emtricitabine star • Increased risk of fatigue, hepatoto
Rilpivirine-tenofovir DF-emtricitabine or Rilpivirine-tenofovir alafenamide-emtricitabine Rilpivirine (oral) plus a *Preferred* Dual-NRTI Backbone	• Once-daily dosing • Available as a fixed-dose combination • Useful for patients who require treatment with drugs that have significant interactions with *Preferred* agents or who need the convenience of a coformulated, single-tablet, once-daily regimen and are not eligible for dolutegravir	• Limited use for in HIV RNA. RPV is n pretreatment HIV counts <200 cells • Requires close vi trimesters becaus levels. Insufficien • Do not use with p • Requires consider H2 blockers or pr commonly used d • Requires adminis
Abbreviations: NRTI = nucleoside reverse transcriptase inhibitor; INSTI = integrase strand transfer inhibitor; PI = p antiretroviral; PK = pharmacokinetics; PrEP = preexposure prophylaxis		

Source:

- Panel on Treatment of HIV During Pregnancy and Prevention of Perinatal Transmission. Recommendations for the Use of Antiretroviral Drugs During Pregnancy and Interventions to Reduce Perinatal HIV Transmission in the United States. Antepartum Care. Recommendations for use of antiretroviral drugs during pregnancy. Table 6. What to start: initial antiretroviral regimens during pregnancy for people who are antiretroviral-naive. January 31, 2023. [HIV.gov]

Table 3. **Perinatal Guidelines: Recommendations for Use of Antiretroviral Drugs During Pregnancy**

***Insufficient Data* for Use as Initial Regimens in Pregnancy**

These drugs and drug combinations are approved for use in adults, but pregnancy-specific PK or safety data are too limited to make recommendations for use in pregnant people. When a pregnant person presents to care while virally suppressed on one of these drugs or drug combinations, providers should consider whether to continue their current regimen or switch to a recommended ARV regimen.

Insufficient Data	**Advantages**	**Disadvantages**
Bictegravir-tenofovir alafenamide-emtricitabine	• Coformulated as a single, once-daily pill • High barrier to resistance • No food requirement	• Limited PK, toxici • May be associate • Specific timing ar apply if bictegrav (e.g., in prenatal
Doravirine *or* Doravirine-tenofovir DF-lamivudine	• Coformulated with tenofovir DF-lamivudine as single table • No food requirement	• Limited PK, toxici • Initial studies sug in third trimester.

Abbreviations: ARV = antiretroviral; PK = pharmacokinetics

Source:

- Panel on Treatment of HIV During Pregnancy and Prevention of Perinatal Transmission. Recommendations for the Use of Antiretroviral Drugs During Pregnancy and Interventions to Reduce Perinatal HIV Transmission in the United States. Antepartum Care. Recommendations for use of antiretroviral drugs during pregnancy. Table 6. What to start: initial antiretroviral regimens during pregnancy for people who are antiretroviral-naive. January 31, 2023. [HIV.gov]

Table 4. **Perinatal Guidelines: Management of Infants Born to People with HIV Infection**

Types of Antiretroviral Management of Newborns with Perinatal HIV Exposure

Category	Definition
Antiretroviral Therapy Prophylaxis	The administration of one or more antiretroviral drugs to a newborn witho risk of perinatal acquisition of HIV.
Presumptive HIV Therapy	The administration of a three-drug combination antiretroviral regimen to r acquisition of HIV. Presumptive HIV therapy is intended to be preliminary documented to have HIV, but also serves as prophylaxis against HIV acqu to HIV *in utero*, during the birthing process, or during breastfeeding and w
HIV Therapy	The administration of a three-drug antiretroviral regimen at treatment dos newborns with documented HIV infection.

Source:

- Panel on Treatment of HIV During Pregnancy and Prevention of Perinatal Transmission. Recommendations for the Use of Antiretroviral Drugs During Pregnancy and Interventions to Reduce Perinatal HIV Transmission in the United States. Management of infants born to people with HIV: antiretroviral management of newborns with perinatal HIV exposure or HIV infection. January 31, 2023. [HIV.gov]

Table 5. **Perinatal Guidelines: Management of Infants Born to People with HIV Infection**

Neonatal Antiretroviral Management According to Risk of HIV Infection in the Newborn

Level of Perinatal HIV Transmission Risk	Description	Neonatal Antiretroviral Management
Low Risk of Perinatal HIV Transmission	**Infants ≥37 weeks gestation when the mother—** • Is currently receiving and has received at least 10 consecutive weeks of ART during pregnancy, and • Has achieved and maintained or maintained viral suppression (defined as at least two consecutive tests with HIV RNA levels <50 copies/mL obtained at least 4 weeks apart) for the remainder of the pregnancy, and • Has HIV RNA <50 copies/mL at or after 36 weeks and within 4 weeks of delivery, and • Did not have acute HIV infection during pregnancy, and • Has reported good ART adherence, and adherence concerns have not been identified.	Zidovudine for 2 weeks
	Infants born to mothers who do not meet the criteria above or criteria for high risk below but who have an HIV RNA <50 copies/mL at or after 36 weeks gestation	Zidovudine for 4-6 weeks
	Premature infants (<37 weeks gestation) who are not at high risk of perinatal acquisition of HIV	Zidovudine for 4-6 weeks
High Risk of Perinatal HIV Transmission[a,b]	Mothers who did not receive antepartum antiretroviral drugs, *or* Mothers who received only intrapartum antiretroviral drugs, *or* Mothers who received antepartum antiretroviral drugs but did not have viral suppression (defined as at least two consecutive tests with	Presumptive HIV therapy using either: Zidovudine, lamivudine, and nevirapine (treatment dose) from birth for 2-6 weeks (if the duration of the 3-drug regimen is shorter than 6 weeks, zidovudine should be continued alone, to complete a total of 6 weeks of prophylaxis)[d] *or*

Level of Perinatal HIV Transmission Risk	Description	Neonatal Antiretroviral Management
	HIV RNA level <50 copies/mL obtained at least 4 weeks apart) within 4 weeks prior to delivery, *or* Mothers with acute or primary HIV infection during pregnancy or breastfeeding (in which case, **breastfeeding should be immediately discontinued**)[c]	Zidovudine, lamivudine, and raltegravir administered from birth for 2-6 weeks (if the duration of the 3-drug regimen is shorter than 6 weeks, zidovudine should be continued alone, to complete a total of 6 weeks of prophylaxis[d]
Presumed Newborn HIV Exposure	Mothers with unconfirmed HIV status who have at least one positive HIV test at delivery or postpartum *or* Mothers whose newborns have a positive HIV antibody test	Antiretroviral management as described above for newborns with a high risk of perinatal HIV acquisition Infant antiretroviral drugs should be discontinued immediately if supplemental testing confirms that the mother does not have HIV.
Newborn with Confirmed HIV[e]	Positive newborn HIV virologic test/nucleic acid test (NAT)	Start recommended 3-drug antiretroviral regimen using treatment doses (refer to Pediatric Antiretroviral Guidelines)

[a] Zidovudine prophylaxis is recommended for infants born to mothers with HIV-2 monoinfection. If the mother has HIV-1 and HIV-2 infection, the infant antiretroviral regimen should be based on the determination of low or high risk of HIV-1 transmission as described in the above table. Because HIV-2 is not susceptible to nevirapine, raltegravir should be considered for infants at high risk of perinatal HIV-2 acquisition.
[b] See the Intrapartum Care section for guidance on indications for scheduled cesarean delivery and intrapartum intravenous zidovudine to reduce the risk of perinatal HIV transmission for mothers with elevated viral load at delivery.
[c] Most Panel members would opt to administer empiric HIV therapy to infants whose mothers had acute HIV during pregnancy because of the high risk for *in utero* transmission. If acute HIV is diagnosed during breastfeeding, the mother should immediately discontinue breastfeeding.
[d] The optimal duration of presumptive HIV therapy in newborns who are at a high risk for perinatal HIV acquisition is unknown. Newborns who are at high risk of HIV acquisition should receive the zidovudine component of the three-drug presumptive HIV therapy regimen for 6 weeks. The other two antiretrovirals (lamivudine and nevirapine or lamivudine plus raltegravir) may be administered for 2 to 6 weeks; the recommended duration for treatment with three antiretroviral varies depending on infant HIV NAT results, maternal viral load at the time of delivery, and additional risk factors for HIV transmission including breastfeeding. Consultation with an expert in pediatric HIV is recommended when selecting a therapy duration because this decision should be based on case-specific risk factors and interim infant HIV NAT results.
[e] Infant antiretroviral therapy should be initiated without waiting for the results of confirmatory HIV NAT testing, given the low likelihood of a false-positive HIV NAT. However, the specimen for confirmatory HIV testing should be obtained prior to antiretroviral initiation.

Note: Antiretroviral drugs should be initiated as close to the time of birth as possible, preferably within 6 hours of delivery.

Key to Acronyms: NAT = nucleic acid test

Source:

- Panel on Treatment of HIV During Pregnancy and Prevention of Perinatal Transmission. Recommendations for the Use of Antiretroviral Drugs During Pregnancy and Interventions to Reduce Perinatal HIV Transmission in the United States. Management of infants born to people with HIV: antiretroviral management of newborns with perinatal HIV exposure or HIV infection. January 31, 2023. [HIV.gov]

Table 6. **Perinatal Guidelines: Management of Infants Born to People with HIV Infection**

Antiretroviral Dosing Recommendations for Newborns

Drug	Drug Doses by Gestation Age at Birth
Zidovudine Note: For newborns unable to tolerate oral agents, the IV dose is 75% of the oral dose while maintaining the same dosing interval.	**≥35 Weeks Gestation at Birth** *Birth to Age 4 Weeks:* • Zidovudine 4 mg/kg/dose orally twice daily or alternative simplified weight-band dosing (see below) *Age >4 weeks:* • Zidovudine 12 mg/kg per dose orally twice daily; only make this dose increase for infants with confirmed HIV infection **Simplified Weight-Band Dosing for Newborns Aged ≥35 Weeks Gestation from Birth to 4 Weeks** Weight Band — Volume of Zidovudine 10 mg/mL Oral Syrup Twice Daily 2 to <3 kg — 1 mL 3 to <4 kg — 1.5 mL 4 to <5 kg — 2 mL
	≥30 to <35 Weeks Gestation at Birth *Birth to Age 2 Weeks:* • Zidovudine 2 mg/kg per dose orally twice daily *Age 2 Weeks to 6 to 8 Weeks:* • Zidovudine 3 mg/kg per dose orally twice daily *Age >6 to 8 Weeks:* • Zidovudine 12 mg/kg per dose orally twice daily; make this dose increase only for infants with confirmed HIV infection
	<30 Weeks Gestation at Birth *Birth to Age 4 Weeks:* • Zidovudine 2 mg/kg per dose orally twice daily *Age 4 to 8 to 10 Weeks:* • Zidovudine 3 mg/kg per dose orally twice daily *Age >8 to 10 Weeks:*

Drug	Drug Doses by Gestation Age at Birth
	• Zidovudine 12 mg/kg per dose orally twice daily; only make this dose increase for infants with confirmed HIV
Abacavir Provided HLA-B5701 allele testing is negative Note: abacavir is not approved by the FDA for use in neonates and infants aged <1 month. However, dosing recommendations have been modeled using PK simulation. Because of abacavir-associated hypersensitivity, negative testing for HLA-B5701 allele should be confirmed prior to administration of abacavir.	**≥37 Weeks' Gestation at Birth** *Birth to 1 Month:* • Abacavir 2 mg/kg per dose orally twice daily *Age 1 Month to <3 Months:* • Abacavir 4 mg/kg per dose orally twice daily
Lamivudine	**≥32 Weeks' Gestation at Birth** *Birth to Age 4 Weeks:* • Lamivudine 2 mg/kg/dose orally twice daily *Age >4 Weeks:* • Lamivudine 4 mg/kg per dose orally twice daily
Nevirapine	**≥37 Weeks Gestation at Birth:** *Birth to Age 4 Weeks:* • Nevirapine 6 mg/kg per dose orally twice daily *Age >4 Weeks:* • Nevirapine 200 mg/m^2 of body surface area (BSA) per dose orally twice daily; only make this dose increase for infants with confirmed HIV infection. **Note**: Nevirapine dose adjustment at 4 weeks of age is optional for empiric HIV therapy
	≥34 to <37 Weeks Gestation at Birth *Birth to Age 1 Week:* • Nevirapine 4 mg/kg per dose orally twice daily *Age 1 to 4 Weeks:* • Nevirapine 6 mg/kg per dose orally twice daily

<table>
<tr><th>Drug</th><th colspan="2">Drug Doses by Gestation Age at Birth</th></tr>
<tr><td></td><td colspan="2">Age >4 Weeks:

• Nevirapine 200 mg/m^2 of BSA per dose orally twice daily; only make this dose increase for infants with confirmed HIV infection.</td></tr>
<tr><td></td><td colspan="2">≥32 to <34 Weeks' Gestation at Birth

Birth to Age 2 Weeks

• Nevirapine 2 mg/kg per dose orally twice daily

Age 2 to 4 Weeks

• Nevirapine 4 mg/kg per dose orally twice daily

Age 4 to 6 Weeks

• Nevirapine 6 mg/kg per dose orally twice daily

Age >6 Weeks

• Nevirapine 200 mg/m^2 BSA per dose orally twice daily; only make this dose increase for infants with confirmed HIV infection.</td></tr>
<tr><td>Raltegravir

Note: If the mother has taken raltegravir 2 to 24 hours prior to delivery, the neonate's first dose of raltegravir should be delayed until 24 to 48 hours after birth; additional antiretroviral drugs should be started as soon as possible.</td><td colspan="2">≥37 Weeks Gestation at Birth and Weighing ≥2 kg

Birth to Age 6 Weeks:

<table>
<tr><td>Body Weight</td><td>Volume (Dose) of Raltegravir 10 mg/mL Suspension</td></tr>
<tr><td>Birth to 1 Week: Once Daily Dosing</td><td>Approximately 1.5 mg/kg per dose</td></tr>
<tr><td>2 to <3 kg</td><td>0.4 mL (4 mg) once daily</td></tr>
<tr><td>3 to <4 kg</td><td>0.5 mL (5 mg) once daily</td></tr>
<tr><td>4 to <5 kg</td><td>0.7 mL (7 mg) once daily</td></tr>
<tr><td>1 to 4 Weeks: Twice Daily Dosing</td><td>Approximately 3 mg/kg per dose</td></tr>
<tr><td>2 to <3 kg</td><td>0.8 mL (8 mg) twice daily</td></tr>
<tr><td>3 to <4 kg</td><td>1 mL (10 mg) twice daily</td></tr>
<tr><td>4 to <5 kg</td><td>1.5 mL (15 mg) twice daily</td></tr>
<tr><td>4 to 6 Weeks: Twice Daily Dosing</td><td>Approximately 6 mg/kg per dose</td></tr>
<tr><td>3 to <4 kg</td><td>2.5 mL (25 mg) twice daily</td></tr>
<tr><td>4 to <6 kg</td><td>3 mL (30 mg) twice daily</td></tr>
<tr><td>6 to <8 kg</td><td>4 mL (40 mg) twice daily</td></tr>
</table></td></tr>
</table>

Source:

- Panel on Treatment of HIV During Pregnancy and Prevention of Perinatal Transmission. Recommendations for the Use of Antiretroviral Drugs During Pregnancy and Interventions to Reduce Perinatal HIV Transmission in the United States. Management of infants born to people with HIV: antiretroviral management of newborns with perinatal HIV exposure or HIV infection. January 31,

2023. [HIV.gov]