Recommendations for the Use of Antiretroviral Drugs During Pregnancy: Overview

(Last updated December 30, 2021; last reviewed December 30, 2021)

Panel’s Recommendations

- When choosing an antiretroviral (ARV) drug regimen for use in pregnant people, providers and patients should consider multiple factors, including adverse effects, drug interactions, pharmacokinetics (PKs), convenience of the individual drugs and drug combinations in the regimen, available pregnancy safety and outcome data, virologic efficacy in nonpregnant adults, and the patient’s resistance test results and comorbidities (AIII).
- The same regimens that are recommended for the treatment of nonpregnant adults should be used in pregnant people when sufficient data suggest that appropriate drug exposure is achieved during pregnancy; clinicians should weigh the risks of adverse effects for pregnant people, fetuses, or infants against the benefits of these regimens and recognize that safety data of ARV drugs in pregnancy are often incomplete (AII). For more information, see Table 4 and Table 5.
- In most cases, people who present for obstetric care on fully suppressive ARV regimens should continue their current regimens (AIII).
- PK changes in pregnancy may lead to lower plasma levels of some ARV drugs and necessitate increased doses, more frequent dosing, boosting, more frequent viral load monitoring, or a change in ARV regimen; see Pregnant People with HIV Who Are Currently Receiving Antiretroviral Therapy (AII).
- The Panel emphasizes the importance of counseling and informed decision-making regarding all ARV regimens for people with HIV (AIII). For additional information, see Prepregnancy Counseling and Care for Persons of Childbearing Age with HIV, Teratogenicity, Appendix C: Antiretroviral Counseling Guide for Health Care Providers, and Table 4 and Table 5.
- After delivery, clinicians should discuss reproductive desires, the risks and benefits of conceiving on the current ARV regimen, and contraceptive options (AII). See Prepregnancy Counseling and Care for Persons of Childbearing Age with HIV and Postpartum Follow-Up for more information.

Rating of Recommendations: A = Strong; B = Moderate; C = Optional
Rating of Evidence: I = One or more randomized trials with clinical outcomes and/or validated laboratory endpoints; II = One or more well-designed, nonrandomized trials or observational cohort studies with long-term clinical outcomes; III = Expert opinion

This section provides an overview of the key clinical and pharmacokinetic (PK) issues that are relevant to the selection of specific antiretroviral (ARV) drugs for use in pregnancy. Additional recommendations for pregnant people with HIV who have never received antiretroviral therapy (antiretroviral therapy [ART]-naive), pregnant people who are currently receiving ART, and those who were previously on ART or who have used ARV drugs for prophylaxis can be found in the other sections that follow this overview. Table 4 provides specific information about recommended ARV drugs when initiating ART in pregnant people who ART-naive. The table also includes considerations for ARV regimen selection and modification in pregnant people who are treatment-experienced and people who are attempting to become pregnant. For recommendations about the use of ARV drugs in people of childbearing potential who are not actively trying to conceive, see the Guidelines for the Use of Antiretroviral Agents in Adults and Adolescents Living with HIV.
Table 5 consolidates situation-specific recommendations for the use of ARV drugs in people with HIV during conception and pregnancy into a single table for ease of reference. Table 5 includes recommendations for the use of ARV drugs in the following situations:

- Initiating ART in pregnant people who have never received ARV drugs;
- Continuing ART in people who become pregnant while on a fully suppressive regimen that has been well tolerated;
- Restarting ART in pregnant people who received ART or ARV drugs for prophylaxis in the past;
- Changing to a new ARV regimen in pregnant people whose current ART is not well tolerated and/or is not resulting in viral suppression; and
- Initiating or modifying ART in people who are trying to conceive.

Table 11 and Appendix B provide information about individual drugs, including dosing and PK data in pregnancy.

Pregnant people often are excluded from initial HIV clinical trials. As a result, data regarding the PKs, drug safety, and efficacy of new ARVs often are limited to nonpregnant adults. Efficacy of ARVs for treatment of pregnant people can be extrapolated from evidence of efficacy in nonpregnant adults, as long as direct PK evaluation in pregnant people demonstrates drug exposures in pregnancy that are within the effective range in nonpregnant adults. Similarly, ART regimens that result in viral suppression throughout pregnancy are likely to be effective in preventing vertical transmission of HIV. In contrast, ART safety cannot be extrapolated and should be evaluated directly in pregnant people. However, drugs with known benefits to people who are not pregnant should not be withheld during pregnancy unless they have known adverse effects to people who are pregnant, fetuses, or infants and these adverse effects outweigh the benefits to pregnant patients or adequate drug levels are not likely to be attained during pregnancy. Pregnancy and the potential for pregnancy should not preclude the use of optimal drug regimens. The decision about which ARV drugs to use during pregnancy should be made by patients after discussing the known and potential benefits and risks to themselves and their fetuses with their health care providers (see Appendix C: Antiretroviral Counseling Guide for Health Care Providers).

The Panel on Treatment of HIV During Pregnancy and Prevention of Perinatal HIV Transmission (the Panel) reviews clinical trial data published in peer-reviewed journals and data prepared by manufacturers for U.S. Food and Drug Administration review that are related to the treatment of adult women with HIV, both those who are pregnant and those who are not. The durability, tolerability, and simplicity of a medication regimen are particularly important for ensuring adherence and preserving future treatment options. Regimen selection should be based on several factors that apply to all people who are pregnant, as well as factors that will vary for individual patients.

Pregnancy-related factors include—

- Potential short-term and long-term adverse effects on fetuses or newborns, such as possible risk of teratogenicity, preterm birth, or effects on growth and development.
• Available safety and outcome data on the use of the drug in pregnancy, including association with adverse pregnancy outcomes, such as preterm delivery;  

• PK changes in pregnancy; and  

• Potential adverse effects for the patient, especially those that may be exacerbated during pregnancy.

Individual-level factors include—  

• Potential drug interactions with other medications;  

• Results of resistance testing and the patient’s prior exposure to ARV drugs;  

• Comorbidities;  

• Ability of the patient to adhere to a regimen; and  

• Convenience and patient preference.

The Panel uses information from several sources to develop recommendations on specific drugs or regimens for pregnant people. These sources include—

• Data from randomized clinical trials and prospective cohort studies that demonstrate durable viral suppression in pregnancy, as well as immunologic and clinical improvement;  

• Incidence rates and descriptions of short-term and long-term drug toxicity of ARV regimens;  

• Evidence from clinical studies on the risk of maternal toxicity, teratogenicity, adverse pregnancy outcomes, and adverse infant outcomes;  

• Specific knowledge about drug tolerability and simplified dosing regimens;  

• Known efficacy of ARV drug regimens in reducing perinatal transmission of HIV when data are available, evidence of high rates of viral suppression during pregnancy, or evidence of high rates of viral suppression in nonpregnant patients with PK (drug exposure) data in pregnancy demonstrating exposures similar to those in nonpregnant patients;  

• PK (drug exposure) data during pregnancy;  

• Data from animal teratogenicity studies; and  

• Antiretroviral Pregnancy Registry data and other post-marketing surveillance data.4

ARV drugs and drug combinations for use in pregnancy are categorized as follows:

• Preferred: Drugs or drug combinations are designated as Preferred for therapy in pregnant people when clinical trial data in adults have demonstrated efficacy and durability with acceptable toxicity and ease of use and when pregnancy-specific PK 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 ARV drug options; the assessment of risks and benefits should incorporate outcomes for pregnant people, fetuses, and infants. 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 trying to conceive.

- **Alternative:** Drugs or drug combinations are designated as Alternative options for therapy in pregnant people 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 trying to conceive.

- **Insufficient Data to Recommend:** The drugs and drug combinations in this category are approved for use in adults, but pregnancy-specific PK or safety data are too limited to make a recommendation for use in pregnant people. In some cases, it may be appropriate to continue using these drugs or drug combinations in patients who become pregnant on ART that has been well tolerated.

- **Not Recommended Except in Special Circumstances:** Although some drugs are not recommended for initial ART in ART-naive people because of specific safety concerns or very limited safety and efficacy data in pregnancy, there may be circumstances in which ART-experienced people need to initiate or continue using specific drugs to reach or maintain viral suppression.

- **Not Recommended:** Drugs and drug combinations listed in this category are not recommended for use in pregnancy because of inferior virologic efficacy or potentially serious maternal or fetal safety concerns. Drugs not recommended for initial therapy in ARV-naive populations, are also categorized as Not Recommended in pregnancy. This category includes drugs or drug combinations for which PK data demonstrate low drug levels and risk of viral rebound during pregnancy. Levels of these drugs are often low in late pregnancy (during the second and third trimesters) when risk for perinatal transmission is high if maternal viremia occurs. In some situations, it may be appropriate to continue using these drugs or drug combinations in people who become pregnant on fully suppressive ART that has been well tolerated, although viral load monitoring should be performed more frequently in these instances. See Pregnant People with HIV Who Are Currently Receiving Antiretroviral Therapy and Monitoring During Pregnancy.

Selection of ARV drugs should be individualized according to a pregnant patient’s specific ARV history, the results of drug-resistance assays, and the presence of comorbidities, as well as the individual patient’s preferences for balancing known and unknown risks and benefits. In people who are pregnant or are trying to conceive, ART that includes at least three agents is recommended. For people who are ARV-naive, an ARV regimen that includes two nucleoside reverse transcriptase inhibitors (NRTIs) and an integrase strand transfer inhibitor (INSTI) or a ritonavir (RTV)-boosted protease inhibitor (PI) is preferred (Table 4).

In general, people who are already on a fully suppressive regimen when pregnancy occurs should continue their regimens. Key exceptions include regimens that involve medications that are not recommended for use in adults because of high risk for toxicity (e.g., didanosine [ddI], indinavir [IDV], stavudine [d4T], and treatment-dose RTV) or inferior virologic efficacy (nelfinavir [NFV]),...
and drugs that should not be used during pregnancy because of PK concerns (see Table 4). For patients who have achieved viral suppression and become pregnant while receiving regimens with a potential increased risk of virologic failure during pregnancy due to PK concerns (e.g., cobicistat (COBI)-boosted regimens) or who are receiving regimens with insufficient data available in pregnancy (e.g., bictegravir [BIC], doravirine [DOR], or long-acting injectable cabotegravir and rilpivirine [CAB/RPV]), clinicians should consider whether to continue or change the ARV regimen, see Pregnant People with HIV Who Are Currently Receiving Antiretroviral Therapy. A regimen change carries a risk for viral rebound at the time of the switch.5 If a decision is made with the patient to continue the same regimen, viral load should be monitored more frequently (i.e., every 1–2 months).

People who are not fully suppressed and who are currently taking ART should be evaluated carefully for adherence and resistance, with every effort made to achieve rapid and full viral suppression through adherence interventions or medication changes (see Pregnant People Who Have Not Achieved Viral Suppression on Antiretroviral Therapy). When treating patients who have received ARV drugs previously but who are not currently taking ARV drugs, clinicians will need to take previous regimens and the potential for genotypic resistance into consideration. Specific recommendations for each type of patient are described in Table 5 and in the following sections: Pregnant People with HIV Who Have Never Received Antiretroviral Drugs, Pregnant People with HIV Who Are Currently Receiving Antiretroviral Therapy, and Pregnant People with HIV Who Have Previously Received Antiretroviral Treatment or Prophylaxis but Are Not Currently Receiving Any Antiretroviral Medications.

Balancing Risks and Benefits of ART in the Face of Limited Data

It is important to weigh the available data about risks and benefits of all Preferred and Alternative agents. These agents include dolutegravir (DTG), atazanavir/ritonavir (ATV/r), darunavir/ritonavir (DRV/r), and raltegravir (RAL) (Preferred), as well as efavirenz (EFV) and rilpivirine (RPV) (Alternative), and NRTI backbone drugs, including abacavir (ABC), lamivudine (3TC), emtricitabine (FTC), tenofovir disoproxil fumarate (TDF), tenofovir alafenamide (TAF) (all Preferred), and zidovudine (ZDV) (Alternative). Of these, systematic birth-surveillance data are available only for TDF, FTC, 3TC, EFV, and DTG.6–7 Although early data raised concerns about risk for neural tube defects (NTDs) associated with preconception or periconception use of other ARV drugs or their use during early pregnancy (see Teratogenicity, Dolutegravir, Elvitegravir, Raltegravir, and Bictegravir). To determine whether a drug carries an increased risk of a rare event—such as an NTD—more than 2,000 periconception exposures need to be monitored to rule out a threefold increase in risk. Clinicians are encouraged to submit to the Antiretroviral Pregnancy Registry data for all patients who conceive while receiving ARV drugs or who receive ARV drugs during pregnancy.

The risk of other adverse pregnancy outcomes, many of which are more common than birth defects, also should be considered. For example, the use of PIs, particularly lopinavir/ritonavir (LPV/r), has been associated with an increased risk of preterm birth, which may lead to an increase in infant morbidity and mortality.5–8 In addition, data are needed on important clinical pregnancy outcomes, such as hypertension and weight gain (see Antiretroviral Drug Regimens and Maternal and Neonatal Outcomes). In the Tsepamo study in Botswana, the risks of adverse pregnancy outcomes other than NTDs were similar for women who received DTG-based regimens and women who received EFV-based regimens.9–11 Overall, data are extremely limited on the risks associated with using other
Preferred and Alternative ARV drugs preconception or in very early pregnancy; this lack of data does not indicate either the presence or absence of risk when using medications other than DTG and EFV. It remains critically important to counsel all patients on the potential risks and benefits of ARV drugs to promote informed, individual decision-making (see Appendix C: Antiretroviral Counseling Guide for Health Care Providers).

Pharmacokinetic Considerations for Antiretroviral Drugs

Physiologic changes that occur during pregnancy can affect drug absorption, distribution, biotransformation, and elimination; thereby also affecting requirements for drug dosing and, potentially, increasing the risk for virologic failure or drug toxicity. During pregnancy, gastrointestinal transit time becomes prolonged, and body water and fat increase throughout gestation. These changes are accompanied by increases in cardiac output, ventilation, and liver and renal blood flow. Plasma protein concentrations also decrease, which can reduce the total plasma drug levels but not necessarily the free or unbound plasma drug levels. Furthermore, renal sodium reabsorption increases, and changes occur in cellular transporters and drug metabolizing enzymes in the liver and intestine. Placental transport of drugs, compartmentalization of drugs in the embryo/fetus and placenta, biotransformation of drugs by the fetus and placenta, and elimination of drugs by the fetus can also affect drug PKs in the pregnant woman. In general, the PKs of NRTIs and non-nucleoside reverse transcriptase inhibitors (NNRTIs) are similar in pregnant and nonpregnant women (although PK data for etravirine [ETR] are limited). PI and INSTI PKs are more variable, particularly during the second and third trimesters. Currently available data on the PKs and dosing of ARV drugs in pregnancy are listed for each drug below and summarized in Table 11.

Nucleoside Reverse Transcriptase Inhibitors

Preferred NRTI combinations for use in ARV-naive pregnant women are abacavir (ABC) used in combination with lamivudine (3TC), and tenofovir disoproxil fumarate (TDF) or tenofovir alafenamide (TAF), used in combination with emtricitabine (FTC) or 3TC.

Abacavir plus lamivudine is the NRTI component in some Preferred regimens for nonpregnant adults. It offers the advantage of once-daily dosing and is well tolerated in pregnancy. Testing for the HLA-B*5701 allele should be performed and documented as negative before starting ABC, and women should be educated about symptoms of hypersensitivity reactions. Clinicians should determine whether a patient has hepatitis B virus (HBV)/HIV coinfection; for women with HBV/HIV coinfection, two NRTIs that are active against HBV should be chosen (e.g., TDF with FTC or 3TC) in place of ABC plus 3TC (see HBV/HIV Coinfection).

Tenofovir disoproxil fumarate or tenofovir alafenamide plus emtricitabine or lamivudine are the NRTI components in some Preferred regimens for nonpregnant adults. These combinations have several advantages, including reassuring PK data, extensive experience with use in pregnancy, once-daily dosing, enhanced activity against HBV, and less toxicity than ZDV plus 3TC. The efficacy and toxicity of TDF and TAF in pregnant patients are similar. In the International Maternal Pediatric Adolescent AIDS Clinical Trials (IMPAACT) 2010 trial, no differences were observed in viral suppression, grade 3 or higher adverse events, or estimated creatinine clearance among people randomized to initiate TDF/FTC (n = 215) versus TAF/FTC (n = 217) with DTG at >14 weeks gestational age. In this study, fewer adverse birth outcomes were observed with the TAF/FTC regimen than with the TDF/FTC regimens (24% vs. 33%, absolute risk difference −8.8%; 95% confidence interval (CI), −17.3% to −0.3%), which may be due to the higher proportion of
women with low gestational weight gain in the TDF/FTC arm (15.0% vs. 23.6%). However, more women in the TAF/FTC arm had high gestational weight gain than in the TDF/FTC arm. High gestational weight gain was not associated with adverse outcomes in this study, but modeling suggests that, over time, excess weight gain with regimens containing TAF and DTG may lead to increased pre-pregnancy weight and obesity-related adverse pregnancy outcomes. Additionally, there have been concerns about bone and growth abnormalities in infants who were exposed to TDF in utero, but the duration and clinical significance of study findings require further evaluation (see Tenofovir Disoproxil Fumarate).

Zidovudine plus lamivudine is an Alternative NRTI combination for ARV-naive pregnant people. Despite proven efficacy in preventing perinatal HIV transmission and extensive experience with use in pregnancy, this NRTI combination is classified as Alternative rather than Preferred because it requires twice-daily dosing and is associated with higher rates of mild-to-moderate adverse effects, including nausea, headache, and reversible maternal and neonatal anemia and neutropenia (see Zidovudine).

Pregnant people who are receiving didanosine or stavudine should be switched to Preferred or Alternative medications.

**Integrase Strand Transfer Inhibitors**

Dolutegravir (DTG) is a Preferred INSTI for pregnant people because there are sufficient data about the PK, efficacy, and safety of DTG when it is initiated during pregnancy. The Panel has reviewed all the data available as of October 2021 regarding DTG use preconception or during the first trimester of pregnancy. Based on these data, DTG is considered a Preferred drug for use throughout pregnancy and for people who are trying to conceive (see the Adult and Adolescent Antiretroviral Guidelines).

**Efficacy and tolerability.** DTG is associated with higher rates of viral suppression, faster rates of viral load decline, greater tolerability, and a higher genetic barrier to drug resistance than other Preferred and Alternative agents. Two randomized clinical trials that compared DTG plus two NRTIs to EFV plus two NRTIs in ART-naive women who initiated therapy during pregnancy found that DTG-based ART produced more rapid viral suppression, with a greater proportion of women reaching an undetectable viral load (<50 copies/mL) at the time of delivery. Higher rates of viral suppression did not translate into statistically significantly lower rates of observed vertical transmission with DTG compared with EFV, even though transmission rates were low with both regimens and the studies were not powered to detect small differences. Programmatic data from Brazil also suggest higher rates of viral load suppression at delivery with DTG than with ATV/r.

**Safety.** The large Tsepamo birth-surveillance study in Botswana has shown that the risk of NTDs is lower than previously reported in preliminary data from the study. In this study, DTG exposure around the time of conception was associated with a small but statistically significant increase in the prevalence of infant NTDs in Botswana; see Teratogenicity. In the most recent analysis, the prevalence with periconception DTG (0.15%) was higher than the prevalence for NTDs in infants born to women who were receiving EFV (0.06%) and women without HIV (0.07%), the prevalence was not significantly increased compared with women with HIV receiving any non-DTG ARV regimen at conception (0.10%, prevalence difference [0.06% difference]; 95% CI, 0.03% to 0.20%) (see Teratogenicity).
If a causal association exists between the use of DTG and the occurrence of NTDs, mechanistic etiologies remain unknown, including whether folic acid deficiency is a mediating factor (thus, whether risk would be reduced by folic acid supplementation) and whether a similar risk may exist for other INSTIs. No link has been established between DTG use and impaired folate metabolism, nor does evidence exist that folate prevents DTG-associated NTDs. Folic acid is known to prevent NTDs in the general population. All pregnant people and people who might conceive should take at least 400 mcg of folic acid daily.

Pharmacokinetics. Although some PK studies have found that DTG levels during the third trimester are lower than a pre-specified target level and lower than levels assessed postpartum, other studies found these changes were not clinically relevant, and data regarding placental transfer and comparisons to levels in nonpregnant adults indicate that dose adjustments are not needed during pregnancy (see Dolutegravir). Furthermore, unbound plasma levels of DTG in pregnant women met the proposed 90% inhibitory concentration for unbound DTG.

Maternal health outcomes. As experience with DTG in pregnancy and the postpartum period accumulates, maternal weight gain during and after pregnancy is an important consideration. Substantial weight gain on DTG-based regimens has been observed in nonpregnant populations, especially among women and among people also receiving TAF. In pregnancy, DTG-associated weight gain also has been observed, but this may reflect better maternal health (e.g., lower rates of insufficient weight gain or weight loss during pregnancy with DTG-based ART). Some studies have seen greater weight gain during pregnancy with TAF/FTC/DTG (0.08 kg/week) and TDF/FTC/DTG (0.03–0.05 kg/week) than with TDF/FTC/EFV while others found no increased weight gain during pregnancy with DTG. However, the weekly weight gain during pregnancy in women on DTG- or EFV-based ART remained less than in women without HIV, less than recommended for the general population. Fewer adverse birth outcomes occurred with DTG, which may be explained by less insufficient weight gain with DTG-based regimens. Postpartum weight gain was greater in women receiving DTG than in those receiving EFV-based ART, but was similar to weight gain in postpartum women without HIV infection in the DolPHIN-2 (Dolutegravir in pregnant HIV mothers and their neonates) perinatal trial.

Raltegravir (RAL) is a Preferred INSTI for use in ARV-naive pregnant people, based on PK, safety, and other data on the use of RAL during pregnancy. Clinical trial and programmatic data demonstrate a more rapid viral decay and greater proportion of viral suppression at delivery with the use of RAL than with EFV or boosted PIs.

Although a once-daily formulation of RAL is approved for use in nonpregnant adults, PK data indicate low drug levels with once-daily dosing in pregnancy, twice-daily dosing remains the recommended dosing schedule.

Elvitegravir/cobicistat (EVG/c) is an INSTI for which data about use in pregnancy are currently limited. Data from the P1026 study and the PANNA study suggest that coadministration of EVG and COBI led to significantly lower levels of both drugs in the third trimester than in the postpartum period (levels in the third trimester were below the levels that are expected to lead to viral suppression). Viral breakthroughs did occur in the P1026 study, with only 74% of women maintaining viral suppression at delivery. Based on these data, EVG/c is Not Recommended for initial use in pregnancy. In a retrospective cohort of 134 women at nine tertiary care centers in the United States who received EVG at any time during pregnancy, viral suppression at delivery was 81% (88% among those who initiated EVG before pregnancy), and overall perinatal HIV...
transmission was 0.8%\textsuperscript{56,60}. In people already receiving EVG/c who become pregnant and are virally suppressed, continuation of the regimen with frequent viral load monitoring during the second and third trimester (e.g., every 1–2 months) can be considered, or the regimen can be switched to another Preferred regimen during pregnancy. If pregnancy is planned, EVG/c can be changed and viral suppression on a new regimen confirmed before conception.

**Bictegravir (BIC)** is an INSTI that is recommended for initial use in nonpregnant adults. No data on BIC PKs in pregnancy have been published, and data on clinical outcomes in pregnancy are extremely limited; in an abstract presented by the manufacturer of BIC, no NTDs were reported among 18 women with prospectively reported periconception exposures.\textsuperscript{61}

**Cabotegravir (CAB)** is an INSTI that is part of a two-drug complete ART regimen available for use as a long-acting injectable formulation (in combination with long-acting injectable RPV) in nonpregnant adults who have RNA levels <50 copies/mL for at least 3 months, are on a stable antiretroviral (ARV) regimen, have no history of treatment failure, and have no known or suspected resistance. Therefore, CAB is Not Recommended for pregnant or nonpregnant people initiating or restarting ART or for those whose current regimen is not well tolerated and/or not fully suppressive. There are insufficient data for people who become pregnant on CAB or those planning to conceive because available pregnancy PK data are limited (n = 3), and data on clinical outcomes in pregnancy are extremely limited.\textsuperscript{62} The Panel recommends that people who conceive while taking long-acting injectable CAB and RPV switch to an oral ART regimen recommended for use during pregnancy; timing of the switch must take into account the long half-life of the long-acting injectable formulation (median 5.6–11.5 weeks) with persistence of the drug for up to 12 months.\textsuperscript{63} With the current dosing schedule of monthly intramuscular (IM) injections, change to an oral regimen should occur within 4 weeks of the last CAB and RPV IM doses.\textsuperscript{64} Dosing recommendations—including guidance for switching to an oral regimen—can be found in the prescribing information\textsuperscript{63,65} and the Adult and Adolescent Antiretroviral Guidelines.

**Protease Inhibitors**

**Atazanavir/ritonavir (ATV/r)** and **darunavir/ritonavir (DRV/r)** are Preferred PIs for use in ARV-naive pregnant people, based on efficacy studies in adults and experience with use in pregnancy. As with RAL, BIC, and EVG/c, data are limited to understand the risk of rare birth defects—such as NTDs—with these ARVs. Factors that affect the decision of which medication to use may include limitations in administering concomitant antacid, H2 blocker, or proton pump inhibitors (for ATV/r) and the requirement for twice-daily dosing (for DRV/r). Although the use of once-daily dosing for DRV/r is approved for nonpregnant adults, PK data are insufficient to support its use in pregnancy.\textsuperscript{66}

**Atazanavir (ATV)** is associated with increased indirect bilirubin levels, which theoretically may increase the risk of hyperbilirubinemia in neonates; however, pathologic elevations have not been seen in studies to date.\textsuperscript{67} In the analyses from the Pediatric HIV/AIDS Cohort Study (PHACS) and Surveillance Monitoring for ART Toxicity (SMARTT) study, in utero exposure to atazanavir was associated with small but statistically significant reductions in language and social-emotional scores compared with exposure to other drugs.\textsuperscript{68} ATV exposure was also associated with the risk of late language emergence at 12 months but was no longer significant at 24 months.\textsuperscript{69,70} The clinical significance of these findings associated with in utero ATV exposure is not known.

**Lopinavir/ritonavir (LPV/r)** is Not Recommended for initiation in pregnancy, except in special circumstances. There are extensive clinical experience and PK data for the use of LPV/r in
pregnancy, but it requires twice-daily dosing in pregnancy and frequently causes nausea and diarrhea; it also has been associated with an increased risk of preterm delivery and small-for-gestational-age infants (see Antiretroviral Drug Regimens and Maternal and Neonatal Outcomes). People who conceive on a suppressive, well-tolerated regimen that includes LPV/r should continue this regimen.

**Darunavir/cobicistat** (DRV/c) and **atazanavir/cobicistat** (ATV/c) are **Not Recommended** for use in pregnancy. PK studies suggest that low levels of both DRV and COBI occur in late pregnancy, and high rates of virologic failure have been observed in late pregnancy among women who were virally suppressed in early pregnancy. Levels of ATV were similarly lower in the second and third trimesters; it is anticipated that the virologic and transmission outcomes with ATV/c will be similar to those observed with DRV/c and EVG/c. In addition, once-daily dosing of DRV is **Not Recommended** for initial therapy in pregnancy. For people who become pregnant while receiving DRV/c or ATV/c and are virally suppressed, the regimen can be continued with frequent viral load monitoring during the second and third trimester (e.g., every 1–2 months), or the regimen can be switched to another **Preferred** regimen during pregnancy. For both DRV and ATV, COBI can be replaced by RTV as the pharmacologic booster, but careful attention must be paid to dosing of ATV (higher if used with TDF or antacids) and DRV (twice-daily dosing).

Current data suggest that with standard adult dosing, plasma concentrations of LPV, ATV, and DRV are reduced during the second and/or third trimesters. Dose adjustment is recommended for LPV/r and may be considered for ATV/r, but dose adjustment is not recommended for DRV/r (see Table 11). Specific dosing recommendations depend on the PI, an individual patient’s treatment experience, and use (if any) of concomitant medications with potential for drug interactions. Clinicians may consider therapeutic drug monitoring in specific situations.

Some older PIs—IDV, NFV, RTV (as the sole PI), and unboosted saquinavir or tipranavir—are **Not Recommended** for use in adults, and others—boosted or unboosted fosamprenavir, saquinavir/ritonavir and tipranavir/ritonavir—are **Not Recommended** for initial therapy in adults. These drugs are **Not Recommended** and should not be used in pregnant people because of concerns that include lower efficacy, toxicities, PK changes in pregnancy, and limited data and experience with use in pregnancy. See Table 4, as well as What Not to Use and Table 11 in the Adult and Adolescent Antiretroviral Guidelines, for details on individual ARV drugs, ARV drug combinations, and ARV regimens that are not recommended or should not be used in adults.

**Non-Nucleoside Reverse Transcriptase Inhibitors**

There are no **Preferred** NNRTIs for use in ARV-naive pregnant people.

Screening for both antenatal and postpartum depression is recommended for all pregnant patients. Because the use of some NNRTIs may increase the risk of depression and suicidality, this screening is particularly critical for patients on EFV- and RPV-containing regimens. Efavirenz (EFV) is an **Alternative** NNRTI for both pregnant and nonpregnant people who are ARV-naive. EFV may be suitable for people who desire a once-daily, fixed-dose combination regimen and who tolerate EFV without adverse effects. Although data on the use of EFV in pregnancy are reassuring with regard to NTDs and preventing vertical transmission of HIV, increased adverse birth outcomes have been observed (composite outcome of preterm delivery, small for gestational age, stillbirth, or spontaneous abortion) with TDF/FTC/EFV compared to TAF/FTC/DTG. Additionally,
adverse effects associated with EFV include dizziness, fatigue, rare and occasionally severe hepatotoxicity, vivid dreams and/or nightmares, and increased risk of suicidality.9,83,85-89

Although EFV was also originally considered to be associated with increased risk for NTDs, large meta-analyses and the data from Botswana described above have been reassuring that the risk of NTDs in infants with first-trimester EFV exposure is not greater than the risk in the general population.7,9,85,86,90 As a result, the Perinatal Guidelines do not restrict the use of EFV in pregnancy or in people who are planning to become pregnant; this is consistent with the British HIV Association Guidelines and the World Health Organization guidelines, both of which note that EFV can be used throughout pregnancy91 (see Teratogenicity and Pregnant People with HIV Who Are Currently Receiving Antiretroviral Therapy). An observational study reported a twofold increased risk of microcephaly among infants born to 141 women receiving EFV compared to women receiving other ARV drugs in the United States; although other factors—such as alcohol use, unintended pregnancy, gestational age at ART initiation, changes in ARV practice patterns over time, and small numbers of women taking more recently recommended ARV drugs as comparators (e.g., DTG [n = 52], RAL [n = 167], and DRV [n = 254])—may have contributed to this association. Importantly, the Panel recommends that people who become pregnant on suppressive, EFV-containing regimens should continue using these regimens as is recommended for most regimens92 (see Table 4 and Table 5).

Rilpivirine (RPV) (oral) may be used as part of an ART regimen for nonpregnant adults with pretreatment HIV RNA <100,000 copies/mL and CD4 T lymphocyte (CD4) cell counts >200 cells/mm³. Sufficient data from use in pregnancy exist to recommend oral RPV as an Alternative agent for pregnant people who meet these same CD4 count and viral load criteria.5,56,93 Although PK data indicate that RPV plasma concentration is reduced during the second and third trimesters, the reduction is less than the reductions seen with EVG/c or DRV/c, and most women will have adequate exposure5; however, viral breakthroughs may be possible. Higher-than-standard doses of RPV have not been studied, so data are insufficient to recommend a dosing change in pregnancy. RPV must be taken with a meal, which may make it difficult to tolerate in pregnancy. With standard dosing of RPV, viral loads should be monitored frequently (e.g., every 1–2 months; see Monitoring During Pregnancy).

Long-acting injectable RPV, used in combination with long-acting injectable CAB is Not Recommended for pregnant people initiating or restarting ART or whose current regimen is not well-tolerated and/or not fully suppressive (see the cabotegravir section above). There are insufficient data for those who become pregnant on long-acting injectable RPV or those planning to conceive because pregnancy PK data are limited and very little data on clinical outcomes in pregnancy exist. The Panel recommends that people who conceive while taking long-acting injectable CAB and RPV switch to an oral ART regimen recommended for use during pregnancy; timing of the switch must take into account the long half-life for long-acting injectable RPV (median 13–28 weeks).63 With the current dosing schedule of monthly IM injections, change to an oral regimen should occur within 4 weeks of the last CAB and RPV IM doses.64 Dosing recommendations—including guidance for switching to an oral regimen—can be found in the prescribing information63,65 and the Adult and Adolescent Antiretroviral Guidelines.

Nevirapine is Not Recommended for initial ART in ARV-naive pregnant people or for nonpregnant adults because of a greater potential for adverse effects, complex lead-in dosing, and a low barrier to resistance. Etravirine is Not Recommended for ARV-naive pregnant patients because it is not recommended for ARV-naive nonpregnant patients and because of insufficient safety and PK data on
the use of ETR during pregnancy. Available PK data in women who received ETR as part of clinical care suggest that a standard adult dose is appropriate during pregnancy; unlike other ARV drugs, ETR exposure is increased during pregnancy. However, it may be appropriate to initiate either of these ARV drugs in special circumstances, or it may be appropriate to continue using them in ART-experienced people who become pregnant on well-tolerated, fully suppressive regimens that include these drugs.

**Doravirine** has not yet been studied in pregnancy; data are insufficient to recommend its use in pregnancy.

**Entry, Attachment, and Fusion Inhibitors**

**Enfuvirtide** and **maraviroc (MVC)** are Not Recommended for initial ART in pregnancy because they are not recommended for initial ART in nonpregnant adults and because the safety and PK data for these drugs in pregnancy are limited. Available PK data in women who received MVC as part of clinical care suggest that a standard adult dose is appropriate during pregnancy, despite a decrease in MVC exposure during pregnancy (see **Maraviroc**). Use of these agents can be considered for pregnant people who have experienced virologic failure with several other classes of ARV drugs and for people who become pregnant on well-tolerated, suppressive regimens that include these drugs; however, data are insufficient to inform safety or dosing guidance for their use in pregnancy, these drugs should be used only after consulting HIV and obstetric specialists.

**Ibalizumab** is a humanized monoclonal antibody to the CD4 receptor. **Fostemsavir** is an attachment inhibitor. Both drugs are indicated for patients with multidrug-resistant HIV for whom no therapeutic alternatives may be available. However, no data exist on the use of these drugs in pregnancy.

**Pharmacologic Boosters**

Low-dose ritonavir as a pharmacologic booster for other PIs, as described above, is currently the preferred pharmacologic booster for use in pregnancy. **Cobicistat**-boosted ARV drugs (ATV, DRV, or EVG) are Not Recommended for use in pregnancy. As noted above, EVG, DRV, ATV, and COBI levels have been found to be significantly lower during the third trimester than during the postpartum period. However, for people who become pregnant while receiving COBI-boosted regimens and are virally suppressed, the regimen can be continued with frequent viral load monitoring during the second and third trimester (e.g., every 1–2 months), or the regimen can be switched to another Preferred regimen during pregnancy. See [Pregnant People with HIV Who Are Currently Receiving Antiretroviral Therapy](#) and [Monitoring During Pregnancy](#) for issues to address with patients when making decisions about whether to switch to another ARV regimen or continue the current regimen with frequent viral load monitoring.
References


11. Lockman S, Brummel SS, Ziemba L, et al. Efficacy and safety of dolutegravir with emtricitabine and tenofovir alafenamide fumarate or tenofovir disoproxil fumarate, and efavirenz, emtricitabine, and tenofovir disoproxil fumarate HIV antiretroviral therapy regimens started in pregnancy (IMPAACT 2010/VESTED): a multicentre, open-label


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88. Martinez de Tejada B, European Pregnancy Paediatric HIV Cohort Collaboration Study Group. Birth defects after exposure to efavirenz-based antiretroviral therapy at


