

Monitoring During Pregnancy

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

Panel's Recommendations

- The plasma HIV RNA levels of pregnant people with HIV should be monitored at the initial antenatal visit **(AI)**, 2 to 4 weeks after initiating (or changing) antiretroviral therapy (ART) **(BI)**, monthly until RNA levels are undetectable **(BIII)**, and then at least every 3 months during pregnancy **(BIII)**. HIV RNA levels also should be assessed at approximately 34 to 36 weeks gestation to inform decisions about mode of delivery (see [Intrapartum Care for People with HIV](#) and to inform decisions about optimal management for the newborn (see [Antiretroviral Management of Newborns with Perinatal HIV Exposure or HIV Infection](#)) **(AIII)**.
- CD4 T lymphocyte (CD4) cell count should be measured at the initial antenatal visit **(AI)**. Patients who have been on ART for ≥ 2 years and who have had consistent viral suppression and CD4 counts that are consistently >300 cells/mm³ do not need to have their CD4 counts monitored after the initial antenatal visit during this pregnancy, per the [Adult and Adolescent Antiretroviral Guidelines](#) **(CIII)**. Patients who have been on ART for <2 years, patients with CD4 counts <300 cells/mm³, and patients with inconsistent adherence and/or detectable viral loads should have CD4 counts monitored every 3 months during pregnancy **(CIII)**.
- HIV drug-resistance testing (genotypic testing and, if indicated, phenotypic testing) should be performed during pregnancy in those whose HIV RNA levels are above the threshold for resistance testing (i.e., >500 copies/mL to 1,000 copies/mL) before—
 - Initiating ART in antiretroviral (ARV)-naive pregnant people who have not been previously tested for ARV drug resistance **(AII)**;
 - Initiating ART in ARV-experienced pregnant people (including those who have received pre-exposure prophylaxis) **(AIII)**; or
 - Modifying ARV regimens for people with HIV who become pregnant while receiving ARV drugs or people who have suboptimal virologic response to ARV drugs that were started during pregnancy **(AII)**. See [Antiretroviral Drug Resistance and Drug Resistance Testing in Pregnancy](#).
- ART should be initiated in pregnant patients prior to receiving the results of ARV-resistance tests. ART should be modified, if necessary, based on the results of resistance testing **(AII)**.
- Laboratory testing to monitor complications of ARV drugs during pregnancy should be based on what is known about the adverse effects of the drugs an individual is receiving **(AIII)**.
- Pregnant people with HIV who are taking ART during pregnancy should undergo standard glucose screening **(AIII)**. Some experts suggest performing glucose screening early in pregnancy for those who are receiving protease inhibitor (PI)-based regimens that were initiated before pregnancy, in accordance with recommendations for patients who are at risk for glucose intolerance **(BIII)**. For more information on PIs, see [Antiretroviral Drug Regimens and Maternal and Neonatal Outcomes](#).
- Amniocentesis, if clinically indicated, should be performed on pregnant people with HIV only after initiation of an effective ARV regimen and, ideally, when HIV RNA levels are undetectable **(BIII)**. If a

pregnant person with detectable HIV RNA levels requires amniocentesis, consultation with an expert in the management of HIV during pregnancy should be considered (BIII).

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

Viral Load and CD4 monitoring

Viral loads should be monitored more frequently in pregnant individuals than in nonpregnant individuals because of the importance of rapid and sustained viral suppression in preventing perinatal HIV transmission, see Table 6 below. Individuals who are adherent to their antiretroviral therapy (ART) and who do not harbor resistance mutations to the prescribed drugs should achieve viral suppression within 8 to 12 weeks. Individuals with higher viral loads and lower CD4 T lymphocyte (CD4) cell counts are more likely to require more time to achieve viral suppression^{1,2} than those with lower viral loads and higher CD4 counts. In addition, those using integrase strand transfer inhibitors (INSTIs) are more likely to achieve suppression in much shorter time frames.^{3–5} Most patients with adequate viral response at 24 weeks of treatment have had at least a 1 log₁₀ viral load decrease within 1 to 4 weeks after starting therapy.^{6,7}

Viral load should be monitored in pregnant patients with HIV at the initial clinic visit, 2 to 4 weeks after initiating or changing ART, monthly until undetectable, and at least every 3 months thereafter. If adherence is a concern, especially during early pregnancy, more frequent monitoring is recommended because of the increased risk of perinatal HIV transmission associated with detectable HIV viremia during pregnancy.^{8–10} Similarly, pregnancy may reduce the drug exposure levels or the efficacy of some drugs; patients who are taking these drugs may require a change in therapy or more frequent viral load monitoring (see [Table 4](#) and [Table 5](#)). More frequent viral load monitoring is recommended for those who are receiving regimens containing rilpivirine or cobicistat-boosted elvitegravir, atazanavir, or darunavir. Although increasing the frequency of viral load monitoring may help detect viral rebound, this may be difficult to implement if visit attendance or access to viral load monitoring is limited. In addition, viremia detected in late pregnancy may be challenging to manage, requiring medication changes shortly before delivery (see [Pregnant People with HIV Who Are Currently Receiving Antiretroviral Therapy](#)).

Viral load also should be assessed at approximately 34 to 36 weeks gestation to inform decisions about the mode of infant delivery and optimal treatment for newborns (see [Intrapartum Care for People with HIV](#)).

In pregnant patients with HIV, CD4 count should be measured at the initial clinic visit (see Table 6 below). For patients who have been on ART for ≥2 years, have had consistent viral suppression and CD4 counts that are consistently >300 cells/mm³, and are tolerating ART during pregnancy, CD4 count should be monitored only at the initial antenatal visit; CD4 counts do not need to be repeated for these patients during this pregnancy, per the [Adult and Adolescent Antiretroviral Guidelines](#).^{6,11,12} Patients who have been on ART for <2 years, patients with CD4 counts of <300 cells/mm³, and those with inconsistent adherence and/or detectable viral loads should have CD4 counts monitored every 3

months during pregnancy. The safety of this approach is supported by research that demonstrates that patients who are stable on ART (defined as patients who have viral load levels <50 copies/mL and CD4 counts >500 cells/mm³ for 1 year) are highly unlikely to experience a CD4 count <350 cells/mm³ in the span of a year.¹³

HIV Drug-Resistance Testing

HIV drug-resistance testing should be performed in pregnant patients with HIV before starting or modifying ART if HIV RNA levels are above the threshold for standard resistance testing (i.e., >500 copies/mL to 1,000 copies/mL) (see Table 6 below). Genotypic testing should be performed. In cases of treatment-experienced individuals with suspected multidrug resistance on failing regimens, phenotypic testing should be additionally performed. See [Drug-Resistance Testing](#) in the [Adult and Adolescent Antiretroviral Guidelines](#) and [Antiretroviral Drug Resistance and Resistance Testing in Pregnancy](#) for more information on resistance testing, including considerations regarding INSTI genotypic resistance testing. ART should not be delayed while waiting for resistance test results. If the results demonstrate resistance, then the regimen can be adjusted subsequently. HIV drug-resistance testing also should be performed on patients who are taking ART but who have suboptimal viral suppression (i.e., failure to achieve undetectable levels of virus during an appropriate time frame, as noted above) or who have sustained viral rebound to detectable levels after prior viral suppression on ART (see [Pregnant People Who Have Not Achieved Viral Suppression on ART](#) and [Antiretroviral Drug Resistance and Resistance Testing in Pregnancy](#)). Drug-resistance testing in the setting of virologic failure is most useful when it is performed while patients are receiving ARV drugs or within 4 weeks after discontinuing drugs. Even if more than 4 weeks have elapsed since the ARV drugs were discontinued, resistance testing can still provide useful information to guide therapy, although it may not detect all resistance mutations that were selected by previous ARV regimens.

Other Laboratory Testing and Monitoring

The laboratory tests that are used to monitor complications of ARV drugs during pregnancy should be chosen based on what is known about the adverse effects of the drugs a patient is receiving (see Table 6 below). For example, routine hematologic monitoring is recommended for patients who are receiving zidovudine-containing regimens, and routine renal monitoring is recommended for patients who are receiving tenofovir disoproxil fumarate. Liver function should be monitored in all patients who are receiving ART, ideally within 2 to 4 weeks after initiating or changing ARV drugs and approximately every 3 months thereafter or as needed for other clinical care. Hepatic dysfunction has been observed in pregnant women on PIs, and the use of any PI during pregnancy has been associated with higher rates of liver function test abnormalities than the rates observed with non-nucleoside reverse transcriptase inhibitor-based ART. Hepatic steatosis and lactic acidosis in pregnancy have been related to the use of older nucleoside reverse transcriptase inhibitors, such as stavudine, didanosine, and zidovudine. Pregnant women in general are more likely to have elevated levels of liver enzymes than their nonpregnant counterparts.^{14–16}

Pregnancy itself increases the risk of glucose intolerance. In a recent meta-analysis, the pooled prevalence of gestational diabetes among women with HIV was 4.42% (95% confidence interval, 3.48% to 5.35%), with women in Asia demonstrating the highest prevalence (7.10%) and those in Africa demonstrating the lowest prevalence (3.19%). These rates do not appear to be higher than those in non-HIV populations.^{17,18} The majority of studies in pregnant women have not demonstrated an association between HIV infection and gestational diabetes,^{19–23} although some studies with

stringent definitions of gestational diabetes did show an increased risk of gestational diabetes in women who were taking PI-based regimens during pregnancy.²⁴ Two studies reported higher odds of gestational diabetes in women who were receiving PI-based regimens,^{25,26} but another prospective study reported that pregnant women with HIV who received PI-containing regimens did not have a greater risk for glucose intolerance or insulin resistance than those who received regimens that did not contain a PI.²⁷ Patients with HIV who are on ART during pregnancy should receive the standard glucose screening that is recommended for all pregnant women. However, some experts would perform glucose screening earlier in pregnancy for patients who are receiving PI-based ART that was initiated before pregnancy, in accordance with recommendations for patients with risk factors for glucose intolerance, such as obesity (see Table 6 below).²⁸

In addition to gestational diabetes risk with some ARV classes, risk for weight gain and obesity both during pregnancy and postpartum may be present with integrase inhibitor use, though existing evidence is inconclusive, with most published data in non-pregnant populations.^{29–33} Current guidelines from the American College of Obstetricians and Gynecologists as well as the National Academy of Medicine recommend that appropriate weight gain, diet, and exercise during pregnancy should be discussed with patients at initial antenatal visits and regularly thereafter.^{34,35}

Accurate estimation of date of delivery is critical when planning scheduled cesarean deliveries at 38 weeks gestation to prevent perinatal transmission in patients with HIV who have elevated HIV RNA viral loads (or when scheduling cesarean delivery or induction for an obstetric indication).³⁶ Therefore, it is recommended that health care providers follow the current obstetric guidelines for gestational age dating by ultrasound.³⁷

Noninvasive methods of aneuploidy screening should be offered, using tests with high sensitivity and low false-positive rates as recommended by the American College of Obstetricians and Gynecologists. Non-invasive screening can be accomplished using any of the following—

- Cell-free DNA screening plus nuchal translucency; *or*
- Serum analyte screening alone or combined with nuchal translucency; *or*
- Ultrasonographic screening alone.³⁸

Patients with HIV who have indications for invasive testing during pregnancy (e.g., abnormal ultrasound or aneuploidy screening) should be counseled about the potential risk of perinatal HIV transmission along with other risks of the procedure so that they can make an informed decision about testing. Although the data on women who are receiving ART are still somewhat limited, the risk of perinatal HIV transmission does not appear to increase with the use of amniocentesis or other invasive diagnostic procedures in women who have virologic suppression on ART.^{39,40} This is in contrast to the era before effective ART, during which invasive procedures, such as amniocentesis and chorionic villus sampling (CVS), were associated with a twofold to fourfold increase in the risk of perinatal transmission of HIV.^{41–44} Although no transmissions occurred among 159 reported cases of amniocentesis or other invasive diagnostic procedures performed in women who were on effective ART, a small increase in the risk of transmission cannot be ruled out.^{45–48} Some experts consider CVS and cordocentesis too risky to offer to patients with HIV, and they recommend limiting invasive procedures to amniocentesis.

At a minimum, pregnant patients should receive effective ART before undergoing any invasive prenatal testing. In addition, they ideally should have undetectable HIV RNA levels at the time of the

procedure, and every effort should be made to avoid inserting the needle through, or very close to, the placenta. If a patient with detectable HIV RNA levels requires amniocentesis, consultation with an expert in the management of HIV during pregnancy should be considered (see [Intrapartum Care for People with HIV](#)).

1 **Table 6. HIV-Related Laboratory Monitoring Schedule for Pregnant People with HIV^a**

Laboratory Test	Timepoint or Frequency of Testing						
	Entry Into Antenatal Care	ART Initiation or Modification	2 to 4 Weeks After ART Initiation or Modification	Monthly	Every 3 Months During Pregnancy	At 24 to 28 Weeks Gestation	At 34 to 36 Weeks Gestation to Inform Mode of Delivery and Infant ARV Regimen
HIV RNA Levels^b	✓	✓ If a result is not available within 2 weeks of ART initiation or modification	✓	✓ Until HIV RNA levels are undetectable	✓ At least every 3 months ^c		✓
CD4 Count^d	✓				✓ For patients who have been on ART for <2 years, patients with CD4 counts <300 cells/mm ³ , and patients with inconsistent adherence and/or detectable viral loads		
Resistance Testing^e		✓					

Standard Glucose Screening^f						✓ For patients on ART ^f	
LFTs for Patients on ART	✓	✓			✓ With additional testing as clinically indicated		
Monitoring for ARV-Specific Toxicities^g	Refer to the recommendations in the package inserts for the individual ARV drugs.						

^a For additional information see [Laboratory Monitoring](#) in the [Adult and Adolescent Antiretroviral Guidelines](#).

^b The plasma HIV RNA levels of pregnant people with HIV should be monitored at the initial antenatal visit (**AI**), 2 to 4 weeks after initiating (or changing) antiretroviral therapy (ART) (**BI**), monthly until RNA levels are undetectable (**BIII**), and then at least every 3 months during pregnancy (**BIII**). Obtain an HIV RNA level at the time of ART initiation or modification if a recent result within 2 weeks prior is not available.

^c More frequent viral load monitoring (every 1–2 months) may be indicated for patients who are taking ARVs that have been shown to have reduced drug levels in the second and third trimesters and are at risk for loss of viral suppression, e.g., cobicistat, elvitegravir, or rilpivirine (see [Table 4](#) and [Table 5](#) and [Pregnant People with HIV Who Are Currently Receiving Antiretroviral Therapy](#)).

^d CD4 T lymphocyte (CD4) cell count should be measured at the initial antenatal visit (**AI**). Patients who have been on ART for ≥2 years and who have had consistent viral suppression and CD4 counts that are consistently >300 cells/mm³ do not need to have their CD4 counts monitored after the initial antenatal visit during this pregnancy, per the [Adult and Adolescent Antiretroviral Guidelines](#) (**CIII**). Patients who have been on ART for <2 years, patients with CD4 counts <300 cells/mm³, and patients with inconsistent adherence and/or detectable viral loads should have CD4 counts monitored every 3 months during pregnancy (**CIII**).

^e ARV drug-resistance testing (genotypic testing and, if indicated, phenotypic testing) should be performed in patients whose HIV RNA levels are above the threshold for standard resistance testing (i.e., >500 copies/mL to 1,000 copies/mL) before—

- Initiating ART in ARV-naive pregnant patients who have not been previously tested for ARV drug resistance (**AII**);
- Initiating ART in ARV-experienced pregnant patients (**AIII**); or
- Modifying ARV regimens for patients who become pregnant while receiving ARV drugs or patients who have suboptimal virologic response to ARV drugs that were started during pregnancy (**AII**).

ART should be initiated in pregnant patients prior to receiving the results of ARV-resistance tests. ART should be modified, if necessary, based on the results of resistance testing (**BIII**).

- 1 † Patients who are taking ART during pregnancy should undergo standard glucose screening **(AIII)**. Some experts suggest performing glucose screening early in pregnancy for
2 patients who are receiving protease inhibitor (PI)-based regimens that were initiated before pregnancy, in accordance with recommendations for patients who are at risk for
3 glucose intolerance **(BIII)**. For more information on PIs, see [Combination Antiretroviral Drug Regimens and Maternal and Neonatal Outcomes](#).
- 4 ‡ Laboratory testing to monitor complications of ARV drugs during pregnancy should be based on what is known about the adverse effects of the drugs a woman is receiving
5 **(AIII)**.
- 6 **Key:** ART = antiretroviral therapy; ARV = antiretroviral; CD4 = CD4 T lymphocyte; LFT = liver function test; PI = protease inhibitor

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