Recommendations for Use of Antiretroviral Drugs in Pregnant HIV-1-Infected Women for Maternal Health and Interventions to Reduce Perinatal HIV Transmission in the United States

Downloaded from http://aidsinfo.nih.gov/guidelines on 3/18/2013

Transmission and Mode of Delivery (Last updated July 31, 2012; last reviewed July 31, 2012)

Panel's Recommendations
• Scheduled cesarean delivery at 38 weeks' gestation to minimize perinatal transmission of HIV is recommended for women with HIV RNA levels >1,000 copies/mL or unknown HIV levels near the time of delivery, irrespective of administration of antepartum antiretroviral (ARV) drugs **(AII)**. Scheduled cesarean delivery is not recommended for prevention of perinatal transmission in pregnant women receiving combination ARV drugs with plasma HIV RNA levels <1,000 copies/mL near the time of delivery **(BIII)**. Data are insufficient to evaluate the potential benefit of cesarean delivery used solely for prevention of perinatal transmission in women with HIV RNA levels <1,000 copies/mL, and given the low rate of transmission in these patients, it is unclear whether scheduled cesarean delivery would confer additional benefit in reducing transmission. In women with HIV RNA levels <1,000 copies/mL, cesarean delivery performed for standard obstetrical indications should be scheduled for 39 weeks' gestation.
• It is not clear whether cesarean delivery after rupture of membranes or onset of labor provides benefit in preventing perinatal transmission. Management of women originally scheduled for cesarean delivery who present with ruptured membranes or in labor must be individualized at the time of presentation based on duration of rupture and/or labor, plasma HIV RNA level, and current ARV regimen **(BII)**.
• Women should be informed of the risks associated with cesarean delivery. If the indication for cesarean delivery is prevention of perinatal transmission of HIV, the risks to a woman should be balanced with potential benefits expected for the neonate **(AII)**.
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*

Basis for Current Recommendations

Scheduled cesarean delivery, defined as cesarean delivery performed before the onset of labor and before rupture of membranes, is recommended for prevention of perinatal transmission of HIV in women with HIV RNA levels >1,000 copies/mL near the time of delivery and for women with unknown HIV RNA levels.[1]

This recommendation is based on findings from a multicenter, randomized clinical trial[2] and from a large individual patient data meta-analysis.[3] These two studies were conducted at a time when the majority of HIV-infected women received no antiretroviral (ARV) medications or zidovudine as a single drug and before the availability of viral load information. Study results have since been extrapolated to make current recommendations about the mode of delivery in an era when combination ARV regimens during pregnancy are recommended and viral load information is readily available.

In the randomized clinical trial, 1.8% of infants born to women randomized to undergo cesarean delivery were HIV infected compared with 10.5% of infants born to women randomized to vaginal delivery ($P < .001$). When adjusted for ARV use in pregnancy (zidovudine alone), scheduled cesarean delivery lowered risk of HIV transmission by 80%, although the results were no longer statistically significant (odds ratio [OR] 0.2; 95% confidence interval [CI], 0–1.7). The protective effect still remained for scheduled delivery (adjusted OR [AOR] 0.3; 95% CI, 0.1–0.8) but not for emergency cesarean delivery (AOR 1.0; 95% CI, 0.3–3.7) when the data were analyzed by actual mode of delivery rather than by the group to which women were allocated.[2] Results from a large meta-analysis of individual patient data from 15 prospective cohort studies also demonstrated the benefit of scheduled cesarean delivery with a 50% reduction in risk.[3] Primarily based on these data, the American College of Obstetricians and Gynecologists (ACOG) has recommended consideration of scheduled cesarean delivery for HIV-infected pregnant women since 1999.[4]

HIV RNA Level of 1,000 copies/mL as a Threshold for Recommendation of Scheduled Cesarean Delivery

The original ACOG committee opinion was updated in 2000 to include further refinements based on HIV RNA levels.[1] Currently, ACOG[1] recommends that women with HIV RNA >1,000 copies/mL be counseled regarding the potential benefits of scheduled cesarean delivery. Initially, the threshold of 1,000 copies/mL was based largely on data from the Women and Infants Transmission Study, a large prospective cohort study that reported no HIV transmission among 57 women with HIV RNA levels less than 1,000 copies/mL.[5] Studies reported since then have demonstrated that HIV transmission can occur in infants born to women with low viral loads.

In an analysis of 957 women with plasma viral loads <1,000 copies/mL, cesarean delivery (scheduled or urgent) reduced risk of HIV transmission when adjusting for potential confounders including receipt of maternal ARV medications; however, zidovudine alone was the regimen primarily used as prophylaxis (AOR 0.30; $P = 0.022$).[6] Among infants born to 834 women with HIV RNA <1,000 copies/mL receiving ARV medications, 8 (1%) were HIV infected. In a more recent report from a comprehensive national surveillance system in the United Kingdom and Ireland, 3 (0.1%) of 2,309 and 12 (1.2%) of 1,023 infants born to women with HIV RNA levels <50 copies/mL and 50 to 999 copies/mL, respectively, were HIV infected.[7]

The recent studies demonstrate that transmission can occur even at very low HIV RNA levels. However, given the low rate of transmission in this group, it is unclear whether scheduled cesarean delivery confers any additional benefit in reducing transmission. Although decisions about mode of delivery for women with HIV RNA levels <1,000 copies/mL should be individualized based on discussion between the obstetrician and the mother, women should be informed that there is no evidence of benefit for scheduled cesarean delivery performed solely for prevention of perinatal transmission in women with HIV RNA <1,000 copies/mL and that it is not routinely recommended in this group.

Scheduled Cesarean Delivery in the Highly Active Antiretroviral Therapy Era

In surveillance data from the United Kingdom and Ireland, pregnant women receiving combination ARV regimens (meaning at least 3 drugs) had transmission rates of about 1%, unadjusted for mode of delivery.[7] Given the low transmission rates achievable with use of maternal combination ARV drug regimens, the benefit of scheduled cesarean delivery is difficult to evaluate. Both the randomized clinical trial[2] and meta-analysis[3] documenting the benefits of cesarean delivery included mostly women who were receiving either no ARVs or zidovudine alone. However, other data partially address this issue.

In a report from the European Collaborative Study that included data from 4,525 women, the overall transmission rate in the subset of women on a combination ARV regimen was 1.2% (11 of 918).[8] In the subset of 560 women with undetectable HIV RNA levels (≤50 to ≤200 copies/mL, depending on site), scheduled cesarean delivery was associated with a significant reduction in perinatal transmission in univariate analysis (OR 0.07; 95% CI, 0.02–0.31; $P = .0004$). However, after adjustment for ARV drug use (none vs. any), the effect was no longer significant (AOR 0.52; 95% CI, 0.14–2.03; $P = .359$). Similarly, data from a European surveillance study did not demonstrate a statistically significant difference in transmission rates between scheduled cesarean delivery and planned vaginal delivery (AOR 1.24; 95% CI, 0.34–4.5) in women on combination ARV regimens.[7] The transmission rate in all women who received at least 14 days of ARV medications was 0.8% (40 of 4,864), regardless of mode of delivery. Therefore, no evidence to date suggests any benefit from scheduled cesarean delivery in women who have been receiving combination ARV medications for several weeks and who have achieved virologic supression.

When the delivery method selected is scheduled cesarean delivery and the maternal viral load is ≥400 copies/mL, administer a 1-hour loading dose and continuous intravenous (IV) zidovudine for 2 hours (3 hours total) before scheduled cesarean delivery. In a study of the pharmacokinetics of IV zidovudine in 28

pregnant women, the ratio of cord blood to maternal zidovudine levels increased significantly in women who received IV zidovudine for 3 to 6 hours compared with <3 hours before delivery (1.0 vs. 0.55, respectively).[9] This suggests that an interval of at least 3 hours may provide adequate time to reach equilibrium across the placenta, although the relationship between specific cord blood zidovudine levels or cord blood-to-maternal-zidovudine levels and efficacy in preventing mother-to-child transmission of HIV is unknown.

Because unscheduled cesarean delivery is performed for both maternal and fetal indications, when an unscheduled cesarean delivery is indicated in a woman who has a viral load ≥400 copies/ml, consideration can be given to shortening the interval between initiation of IV zidovudine administration and delivery. For example, some experts recommend administering the 1-hour loading dose of IV zidovudine and not waiting to complete additional administration before proceeding with delivery.

Women Presenting Late in Pregnancy

HIV-infected women who present late in pregnancy and are not receiving ARV drugs may not have HIV RNA results available before delivery. Without current therapy, HIV RNA levels are unlikely to be <1,000 copies/mL at baseline. Even if combination ARV medications were begun immediately, reduction in plasma HIV RNA to undetectable levels usually takes several weeks, depending on the kinetics of viral decay for a particular drug regimen.[10] In this instance, scheduled cesarean delivery is likely to provide additional benefit in reducing the risk of perinatal transmission of HIV for women, unless viral suppression can be documented before 38 weeks' gestation.

Timing of Scheduled Cesarean Delivery

In general, ACOG recommends that scheduled cesarean delivery not be performed before 39 weeks' gestation because of the risk of iatrogenic prematurity.[11, 12] However, in cases of cesarean delivery performed to prevent transmission of HIV, ACOG recommends scheduling cesarean delivery at 38 weeks' gestation in order to decrease the likelihood of onset of labor or rupture of membranes before delivery.[1] In all women undergoing repeat cesarean delivery, the risk of any neonatal adverse event—including neonatal death, respiratory complications, hypoglycemia, newborn sepsis, or admission to the neonatal intensive care unit—is 15.3% at 37 weeks, 11.0% at 38 weeks, and 8.0% at 39 weeks.[12] Gestational age should be determined by best obstetrical dating criteria, including last menstrual period and early ultrasound for dating purposes. Amniocentesis to document lung maturity should be avoided when possible in HIV-infected women and is rarely indicated before scheduled cesarean section for prevention of HIV transmission.

Among 1,194 infants born to HIV-infected mothers, 9 (1.6%) infants born vaginally had respiratory distress syndrome (RDS) compared with 18 (4.4%) infants born by scheduled cesearean delivery (P <0.001). There was no statistically significant association between mode of delivery and infant RDS in an adjusted model that included infant gestational age and birth weight.[13] Although newborn complications may be increased in planned births <39 weeks' gestation, the benefits of planned cesarean delivery at 38 weeks are generally thought to outweigh the risks if the procedure is performed for prevention of HIV transmission. When cesarean delivery is performed in HIV-infected women for an indication other than decreasing HIV transmission, cesarean delivery should be scheduled at 39 weeks, based on ACOG guidelines.

Risk of Maternal Complications

Administration of perioperative antimicrobial prophylaxis is recommended for all women to decrease maternal infectious morbidity associated with cesarean delivery. Most studies have demonstrated that HIV-infected women have increased rates of postoperative complications, mostly infectious, compared with HIV-uninfected women and that risk of complications is related to degree of immunosuppression.[14-19] Furthermore, a Cochrane review of six studies of HIV-infected women concluded that urgent cesarean delivery was associated with the highest risk of postpartum morbidity, scheduled cesarean delivery was

intermediate in risk, and vaginal delivery had the lowest risk of morbidity.[20] Complication rates in most studies [2, 21-25] were within the range reported in populations of HIV-uninfected women with similar risk factors and not of sufficient frequency or severity to outweigh the potential benefit of reduced perinatal HIV transmission. Therefore, HIV-infected women should be counseled regarding the risks associated with undergoing cesarean delivery and the potential benefits in decreasing perinatal transmission of HIV if HIV RNA levels at term are >1,000 copies/mL.

Management of Women Who Present in Early Labor or With Ruptured Membranes

Few data are available to address the question of whether performing cesarean delivery after the onset of labor or membrane rupture decreases risk of perinatal transmission of HIV. Most studies have shown a similar risk of transmission for cesarean delivery performed for obstetric indications after labor and membrane rupture and for vaginal delivery. In one study, the HIV transmission rate was similar in women undergoing emergency cesarean delivery and those delivering vaginally (1.6% vs. 1.9%, respectively).[7] A meta-analysis of HIV-infected women, most of whom were on zidovudine as a single drug or receiving no ARV medications, demonstrated a 2% increased transmission risk for every additional hour of ruptured membranes.[26] However, it is not clear how soon after the onset of labor or the rupture of membranes the benefit of cesarean delivery is lost.[27] Therefore, the decision about whether to deliver by expeditious cesarean section for prevention of perinatal transmission in women originally scheduled for cesarean delivery who then present with ruptured membranes or in labor must be individualized, taking into account duration of rupture or labor upon presentation, plasma RNA level, and current ARV drug regimen status. The ARV drug regimen should be continued and IV zidovudine initiated, if previously planned.

When membrane rupture occurs before 37 weeks' gestation, decisions about timing of delivery should be based on best obstetrical practices, taking into account risks to the infant of prematurity and of HIV transmission. Steroids should be given, if appropriate, to accelerate fetal lung maturity because no data exist to suggest that these recommendations need to be altered for HIV-infected women. When the decision is made to deliver, route of delivery should be according to obstetrical indications.

Table 8 summarizes recommendations regarding mode of delivery for different clinical scenarios.

Table 8. Clinical Scenarios and Recommendations Regarding Mode of Delivery to Reduce Perinatal Transmission of HIV (page 1 of 2)

Clinical Scenario	Recommendations
HIV-infected women presenting late in pregnancy (after about 36 weeks' gestation), known to be HIV infected but not receiving ARV medications, and who have HIV RNA level and CD4 T-lymphocyte (CD4-cell) counts pending but unlikely to be available before delivery.	• Start antiretroviral (ARV) medications as per Table 6. • Provide counseling on the likelihood that scheduled cesarean delivery will reduce the risk of mother-to-child transmission, if viral suppression cannot be documented before 38 weeks. Include information on increased maternal risks of cesarean delivery, including risks related to anesthesia and surgery and increased rates of postoperative infection. • When the delivery method selected is scheduled cesarean, perform the procedure at 38 weeks' gestation, as determined by best obstetrical dating. • Administer a 1-hour intraveneous (IV) loading dose followed by continuous IV zidovudine for 2 hours (3 hours total) before scheduled cesarean. • Continue other ARV medications on schedule, as much as possible, before and after surgery. • All standard cesarean delivery management should be recommended, including use of prophylactic antibiotics.

Table 8. Clinical Scenarios and Recommendations Regarding Mode of Delivery to Reduce Perinatal Transmission of HIV (page 2 of 2)

Clinical Scenario	Recommendations
HIV-infected women who began prenatal care early in the third trimester, are receiving combination ARV drug regimens, and have an initial virologic response but have HIV RNA levels that remain substantially >1,000 copies/mL at 36 weeks' gestation.	• Continue the current combination ARV regimen if response in HIV RNA level is appropriate. • Consult an expert in HIV infection to determine the appropriateness of additional ARV agents to rapidly further decrease viral load. • Recommend scheduled cesarean delivery if viral load suppression is not achieved by 38 weeks because of the potential additional benefit in preventing intrapartum HIV transmission. Inform woman about the increased maternal risks associated with cesarean delivery, including risks related to anesthesia and surgery and increased rates of postoperative infection. • When the delivery method selected is scheduled cesarean, perform the procedure at 38 weeks' gestation by best obstetrical dating. • When the delivery method selected is scheduled cesarean delivery, administer a 1-hour loading dose and continuous IV zidovudine for 2 hours (3 hours total) before scheduled cesarean. • Continue other ARV medications on schedule, as much as possible, before and after surgery. • All standard cesarean delivery management should be recommended, including the use of prophylactic antibiotics.
HIV-infected women on combination ARV drug regimens with undetectable HIV RNA levels at 36 weeks' gestation.	• Provide counseling on risk of perinatal transmission of HIV with a persistently undetectable HIV RNA level, which is 1% or less, even with vaginal delivery. No evidence currently exists to show that this risk can be lowered further by performing scheduled cesarean delivery. • Risk of complications is increased with cesarean delivery compared with vaginal delivery, and the risks must be balanced against the uncertain benefits of cesarean delivery in women with undetectable viral load.
HIV-infected women with HIV RNA level >1,000 copies/mL who have elected scheduled cesarean delivery but present after rupture of membranes or onset of labor at >37 weeks' gestation.	• Start IV zidovudine immediately. • Individualize the decision regarding mode of delivery based on clinical factors at presentation including duration of rupture and/or labor, plasma RNA level, and current ARV regimen. Management of vaginal delivery, if chosen, should be individualized. Some clinicians may consider administration of oxytocin, if clinically appropriate, in order to expedite delivery. Scalp electrodes and other invasive monitoring and operative delivery should be avoided, if possible, unless there are clear obstetric indications. • When cesarean delivery is chosen, administration of the loading dose of IV zidovudine ideally should be completed before the procedure.

References

1. Committee on Obstetric Practice. ACOG committee opinion scheduled Cesarean delivery and the prevention of vertical transmission of HIV infection. Number 234, May 2000 (replaces number 219, August 1999). *Int J Gynaecol Obstet*. Jun 2001;73(3):279-281. Available at http://www.ncbi.nlm.nih.gov/pubmed/11424912.
2. European Mode of Delivery Collaboration. Elective caesarean-section versus vaginal delivery in prevention of vertical HIV-1 transmission: a randomised clinical trial. *Lancet*. Mar 27 1999;353(9158):1035-1039. Available at

http://www.ncbi.nlm.nih.gov/pubmed/10199349.

3. International Perinatal HIV Group. The mode of delivery and the risk of vertical transmission of human immunodeficiency virus type 1--a meta-analysis of 15 prospective cohort studies. The International Perinatal HIV Group. *N Engl J Med*. Apr 1 1999;340(13):977-987. Available at http://www.ncbi.nlm.nih.gov/pubmed/10099139.
4. American College of Obstetricians and Gynecologists. ACOG committee opinion. Scheduled cesarean delivery and the prevention of vertical transmission of HIV infection. Number 219, August 1999. Committee on Obstetric Practice. American College of Obstetricians and Gynecologists. *Int J Gynaecol Obstet*. Sep 1999;66(3):305-306. Available at http://www.ncbi.nlm.nih.gov/pubmed/10580685.
5. Garcia PM, Kalish LA, Pitt J, et al. Maternal levels of plasma human immunodeficiency virus type 1 RNA and the risk of perinatal transmission. Women and Infants Transmission Study Group. *N Engl J Med*. Aug 5 1999;341(6):394-402. Available at http://www.ncbi.nlm.nih.gov/pubmed/10432324.
6. Ioannidis JP, Abrams EJ, Ammann A, et al. Perinatal transmission of human immunodeficiency virus type 1 by pregnant women with RNA virus loads <1000 copies/ml. *J Infect Dis*. Feb 15 2001;183(4):539-545. Available at http://www.ncbi.nlm.nih.gov/pubmed/11170978.
7. Townsend CL, Cortina-Borja M, Peckham CS, de Ruiter A, Lyall H, Tookey PA. Low rates of mother-to-child transmission of HIV following effective pregnancy interventions in the United Kingdom and Ireland, 2000-2006. *AIDS*. May 11 2008;22(8):973-981. Available at http://www.ncbi.nlm.nih.gov/pubmed/18453857.
8. European Collaborative Study. Mother-to-child transmission of HIV infection in the era of highly active antiretroviral therapy. *Clin Infect Dis*. Feb 1 2005;40(3):458-465. Available at http://www.ncbi.nlm.nih.gov/pubmed/15668871.
9. Rodman JH, Flynn PM, Robbins B, et al. Systemic pharmacokinetics and cellular pharmacology of zidovudine in human immunodeficiency virus type 1-infected women and newborn infants. *J Infect Dis*. Dec 1999;180(6):1844-1850. Available at http://www.ncbi.nlm.nih.gov/pubmed/10558940.
10. European Collaborative Study, Patel D, Cortina-Borja M, Thorne C, Newell ML. Time to undetectable viral load after highly active antiretroviral therapy initiation among HIV-infected pregnant women. *Clin Infect Dis*. Jun 15 2007;44(12):1647-1656. Available at http://www.ncbi.nlm.nih.gov/pubmed/17516411.
11. American College of Obstetricians and Gynecologists. ACOG Practice Bulletin No. 97: Fetal lung maturity. *Obstet Gynecol*. Sep 2008;112(3):717-726. Available at http://www.ncbi.nlm.nih.gov/pubmed/18757686.
12. Tita AT, Landon MB, Spong CY, et al. Timing of elective repeat cesarean delivery at term and neonatal outcomes. *N Engl J Med*. Jan 8 2009;360(2):111-120. Available at http://www.ncbi.nlm.nih.gov/pubmed/19129525.
13. Livingston EG, Huo Y, Patel K, et al. Mode of delivery and infant respiratory morbidity among infants born to HIV-1-infected women. *Obstet Gynecol*. Aug 2010;116(2 Pt 1):335-343. Available at http://www.ncbi.nlm.nih.gov/pubmed/20664394.
14. Grubert TA, Reindell D, Kastner R, Lutz-Friedrich R, Belohradsky BH, Dathe O. Complications after caesarean section in HIV-1-infected women not taking antiretroviral treatment. *Lancet*. Nov 6 1999;354(9190):1612-1613. Available at http://www.ncbi.nlm.nih.gov/pubmed/10560681.
15. Maiques-Montesinos V, Cervera-Sanchez J, Bellver-Pradas J, Abad-Carrascosa A, Serra-Serra V. Post-cesarean section morbidity in HIV-positive women. *Acta Obstet Gynecol Scand*. Oct 1999;78(9):789-792. Available at http://www.ncbi.nlm.nih.gov/pubmed/10535342.
16. Rodriguez EJ, Spann C, Jamieson D, Lindsay M. Postoperative morbidity associated with cesarean delivery among human immunodeficiency virus-seropositive women. *Am J Obstet Gynecol*. May 2001;184(6):1108-1111. Available at http://www.ncbi.nlm.nih.gov/pubmed/11349171.
17. Semprini AE, Castagna C, Ravizza M, et al. The incidence of complications after caesarean section in 156 HIV-positive women. *AIDS*. Aug 1995;9(8):913-917. Available at http://www.ncbi.nlm.nih.gov/pubmed/7576327.
18. Urbani G, de Vries MM, Cronje HS, Niemand I, Bam RH, Beyer E. Complications associated with cesarean section in HIV-infected patients. *Int J Gynaecol Obstet*. Jul 2001;74(1):9-15. Available at

http://www.ncbi.nlm.nih.gov/pubmed/11430935.

19. Vimercati A, Greco P, Loverro G, Lopalco PL, Pansini V, Selvaggi L. Maternal complications after caesarean section in HIV infected women. *Eur J Obstet Gynecol Reprod Biol*. May 2000;90(1):73-76. Available at http://www.ncbi.nlm.nih.gov/pubmed/10767514.
20. Read JS, Newell MK. Efficacy and safety of cesarean delivery for prevention of mother-to-child transmission of HIV-1. *Cochrane Database Syst Rev*. 2005(4):CD005479. Available at http://www.ncbi.nlm.nih.gov/pubmed/16235405.
21. Faucher P, Batallan A, Bastian H, et al. [Management of pregnant women infected with HIV at Bichat Hospital between 1990 and 1998: analysis of 202 pregnancies]. *Gynecol Obstet Fertil*. Mar 2001;29(3):211-225. Available at http://www.ncbi.nlm.nih.gov/pubmed/11300046.
22. Fiore S, Newell ML, Thorne C, European HIV in Obstetrics Group. Higher rates of post-partum complications in HIV-infected than in uninfected women irrespective of mode of delivery. *AIDS*. Apr 9 2004;18(6):933-938. Available at http://www.ncbi.nlm.nih.gov/pubmed/15060441.
23. Marcollet A, Goffinet F, Firtion G, et al. Differences in postpartum morbidity in women who are infected with the human immunodeficiency virus after elective cesarean delivery, emergency cesarean delivery, or vaginal delivery. *Am J Obstet Gynecol*. Apr 2002;186(4):784-789. Available at http://www.ncbi.nlm.nih.gov/pubmed/11967508.
24. Read JS, Tuomala R, Kpamegan E, et al. Mode of delivery and postpartum morbidity among HIV-infected women: the women and infants transmission study. *J Acquir Immune Defic Syndr*. Mar 1 2001;26(3):236-245. Available at http://www.ncbi.nlm.nih.gov/pubmed/11242196.
25. Watts DH, Lambert JS, Stiehm ER, et al. Complications according to mode of delivery among human immunodeficiency virus-infected women with CD4 lymphocyte counts of ≤500/microL. *Am J Obstet Gynecol*. Jul 2000;183(1):100-107. Available at http://www.ncbi.nlm.nih.gov/pubmed/10920316.
26. International Perinatal HIV Group. Duration of ruptured membranes and vertical transmission of HIV-1: a meta-analysis from 15 prospective cohort studies. *AIDS*. Feb 16 2001;15(3):357-368. Available at http://www.ncbi.nlm.nih.gov/pubmed/11273216.
27. Jamieson DJ, Read JS, Kourtis AP, Durant TM, Lampe MA, Dominguez KL. Cesarean delivery for HIV-infected women: recommendations and controversies. *Am J Obstet Gynecol*. Sep 2007;197(3 Suppl):S96-100. Available at http://www.ncbi.nlm.nih.gov/pubmed/17825656.