



Guidelines for Prevention and Treatment of Opportunistic Infections in HIV-Infected Adults and Adolescents

Downloaded from <https://aidsinfo.nih.gov/guidelines> on 12/15/2018

Visit the *AIDSinfo* website to access the most up-to-date guideline.

Register for e-mail notification of guideline updates at <https://aidsinfo.nih.gov/e-news>.

Epidemiology

Infections with human herpes simplex virus type 1 (HSV-1) and type 2 (HSV-2) are common, with a seroprevalence of HSV-1 among adults in the United States of approximately 60% and a seroprevalence of HSV-2 among persons aged ≥ 12 years of 17%.¹ Approximately 70% of HIV-infected persons are HSV-2 seropositive and 95% are seropositive for either HSV-1 or HSV-2.² In most persons, HSV infections are unrecognized clinically. However, regardless of the clinical severity of infection, shedding on mucosal surfaces occurs frequently and can result in transmission. HSV-2 infection increases the risk of HIV acquisition two- to three-fold, and HSV-2 reactivation results in increases in HIV RNA levels in blood and genital secretions of coinfecting patients.

Clinical Manifestations

Orolabial herpes (e.g., cold sores, fever blisters) is the most common manifestation of HSV-1 infection. Classic manifestations include a sensory prodrome in the affected area, rapidly followed by the evolution of lesions from papule to vesicle, ulcer, and crust stages on the lip. The course of illness in untreated patients is 5 to 10 days. Lesions recur 1 to 12 times per year and can be triggered by sunlight or physiologic stress.

Genital herpes is the most common manifestation of HSV-2 infection. Typical genital mucosal or skin lesions evolve through stages of papule, vesicle, ulcer, and crust. Ulcerative lesions are usually the only stage observed on mucosal surfaces, but vesicles are commonly seen on genital skin (e.g., the penile shaft, thighs, pubis). Local symptoms might include a sensory prodrome consisting of pain and pruritis. Mucosal disease is occasionally accompanied by dysuria or vaginal or urethral discharge. Inguinal lymphadenopathy is common with genital herpes, particularly in primary infection.³ These classic manifestations occur in some patients, but most individuals with genital herpes have mild and atypical lesions that are often unrecognized, not brought to medical attention, and cannot reliably be diagnosed by physical examination. HSV is a significant cause of proctitis in men who have sex with men with HIV infection and may not be associated with external anal ulcers.⁴ In profoundly immunocompromised patients, extensive, deep, nonhealing ulcerations can occur. These lesions have been reported most often in those with CD4 T-lymphocyte (CD4) cell counts of < 100 cells/ μL and also may be associated with acyclovir-resistant HSV.⁵ In addition, atypical presentations such as hypertrophic genital HSV,^{6,7} which mimics neoplasia and requires biopsy for diagnosis, may be seen in persons with HIV infection.

An episode of genital HSV-1 disease is indistinguishable from genital HSV-2 disease, but genital HSV-1 recurrences and viral shedding occur less often than with genital HSV-2 infection.

Non-mucosal HSV infections, such as HSV keratitis, HSV encephalitis, HSV hepatitis, and herpetic whitlow, are similar in presentation to manifestations observed in HIV-seronegative individuals; disseminated HSV infection is rare, even in profoundly immunosuppressed patients. HSV retinitis manifests as acute retinal necrosis, which can lead rapidly to loss of vision.

Diagnosis

Because mucosal HSV infections cannot be diagnosed accurately by clinical examination, especially in persons with HIV infection, a laboratory diagnosis should be pursued in all cases.⁸ HSV DNA polymerase chain reaction (PCR), and viral culture are preferred methods for diagnosis of mucocutaneous HSV lesions caused by HSV. PCR is the most sensitive method. The virus detected in genital lesions should be typed because of the prognostic significance—HSV-1 recurs less frequently than HSV-2 in the genital area. Type-specific serologic assays are commercially available and can be used for diagnosis in asymptomatic individuals or those with atypical lesions. Because of the poor sensitivity and specificity of clinical diagnosis,

the extensive interactions between HIV and HSV-2, and the availability of effective therapy for HSV-2, routine type-specific serologic screening for HSV-2 for persons with HIV infection can be considered. Diagnosis of HSV-2 should be accompanied by counseling that includes discussion of the risk of transmitting infection to sex partners. Guidelines for counseling are provided in the 2015 Centers for Disease Control and Prevention sexually-transmitted disease treatment guidelines.⁹

Preventing Exposure

The majority of persons with HIV infection have HSV-1 and HSV-2 infections. However, prevention of acquisition of HSV is important for those who are uninfected. Persons with HIV infection who are HSV-2 seronegative should consider asking their partners to be tested using type-specific serology before initiating sexual activity, because disclosure of HSV-2 in heterosexual HIV-negative HSV-2-discordant couples was associated with reduced risk of transmission of HSV-2 (**BII**).¹⁰ Consistent use of latex condoms reduced HSV-2 acquisition from women to men and from men to women, and their use should be encouraged for prevention of transmission of HSV-2 and other sexually transmitted pathogens (**AII**).^{11,12} Persons with HIV infection should specifically avoid sexual contact when their partners have overt (genital or orolabial) herpetic lesions (**AII**). However, most sexual transmission of HSV occurs during asymptomatic viral shedding.

The use of suppressive antiviral therapy (i.e., valacyclovir 500 mg once daily) in persons without HIV infection with symptomatic genital herpes reduced HSV-2 transmission to susceptible heterosexual partners by 48%.¹³ However, in HIV-1/HSV-2-seropositive persons not on antiretroviral therapy, suppressive acyclovir (400 mg twice daily) did not prevent HSV-2 transmission to HSV-2 seronegative partners.¹⁴ Suppressive anti-HSV therapy is not recommended to prevent HSV-2 transmission in persons with HIV infection who are not on ART (**AI**).

Preventing Disease

Prophylaxis with antiviral drugs to prevent primary HSV infection is not recommended (**AIII**). Although preexposure prophylaxis (PrEP) with vaginal tenofovir and oral tenofovir or tenofovir/emtricitabine has been associated with reduced risk of HSV-2 acquisition in clinical trials in HIV-negative persons^{15,16}, vaginal and oral tenofovir for prevention of HSV-2 has not been studied in persons with HIV infection. The dose, duration, timing, and efficacy of antiviral prophylaxis after known or suspected exposure to HSV have not been evaluated. No vaccine for prevention of HSV infection is available.

Treating Disease

Patients with HSV infections can be treated with episodic therapy when symptomatic lesions occur or with daily suppressive therapy to prevent recurrences. The management plan for genital HSV-2 disease in persons with HIV infection should include consideration of several factors, such as frequency and severity of HSV recurrences, and risk for genital ulcer disease (GUD) when initiating ART. Episodic treatment for individual recurrences does not influence the natural history of genital HSV-2 infection.

Patients with orolabial lesions can be treated with oral acyclovir, valacyclovir, or famciclovir for 5 to 10 days (**AIII**). Genital HSV episodes should be treated with oral acyclovir, valacyclovir, or famciclovir for 5 to 10 days (**AI**). Severe mucocutaneous HSV lesions respond best to initial treatment with intravenous (IV) acyclovir (**AIII**).^{5,17} Patients can be switched to oral antiviral therapy after their lesions have begun to regress. Therapy should be continued until the lesions have completely healed. Disseminated disease due to HSV is rare in persons with HIV infection, although HSV necrotizing retinitis can occur, which may be difficult to distinguish clinically from retinitis caused by varicella-zoster virus (VZV).

Special Considerations with Regard to Starting Antiretroviral Therapy

In most instances, orolabial HSV should not influence the decision about when to start antiretroviral therapy (ART). Persons with HIV infection receiving ART who have had immune reconstitution often have

improvement in the frequency and severity of their clinical episodes of genital herpes. However, immune reconstitution does not reduce the frequency of genital HSV shedding.¹⁸ Chronic cutaneous or mucosal HSV that is refractory to therapy and visceral or disseminated cases of HSV disease (which are uncommon) would be indications to hasten the initiation of ART (**CIII**).

Monitoring of Response to Therapy and Adverse Events (Including Immune Reconstitution Inflammatory Syndrome [IRIS])

Acyclovir, valacyclovir, and famciclovir are occasionally associated with nausea or headache. No laboratory monitoring is needed in patients receiving episodic or suppressive therapy unless they have advanced renal impairment. For patients receiving high-dose IV acyclovir, monitoring of renal function and dose adjustment as necessary are recommended at initiation of treatment and once or twice weekly for the duration of treatment. Thrombotic thrombocytopenic purpura/hemolytic uremic syndrome has been reported in persons with HIV infection treated with high-dose (8 g/day) valacyclovir, but has not been reported at conventional doses recommended for therapy of HSV infection.¹⁹

HSV-2 shedding and genital ulcer disease can increase in the first 6 months after initiation of ART, particularly in those with low CD4 cell count.^{20,21} Mucocutaneous lesions that are atypical and occasionally recalcitrant to therapy have been reported in individuals initiating ART and have been attributed to immune reconstitution inflammatory syndrome (IRIS).²²

Managing Treatment Failure

Treatment failure as a result of resistance to antivirals should be suspected if lesions do not begin to resolve within 7 to 10 days after initiation of therapy. In persons with suspected acyclovir-resistant HSV, viral culture of the lesion should be performed, and if virus is isolated, susceptibility testing done to confirm drug resistance (**AII**).²³ Phenotypic testing of viral isolates has been the gold standard method for assessing HSV resistance; genotypic testing is not yet available.

The treatment of choice for acyclovir-resistant HSV is IV foscarnet (**AI**).^{24,25} IV cidofovir is a potential alternative (**CIII**). Topical trifluridine, cidofovir, and imiquimod also have been used successfully for lesions on external surfaces, although prolonged application for 21 to 28 days or longer may be required (**CIII**).

Preventing Recurrence

Suppressive therapy with oral acyclovir, valacyclovir, or famciclovir is effective in preventing recurrences and is preferred for patients who have severe or frequent HSV recurrences or who want to minimize the frequency of recurrences (**AI**).^{8,26} Suppressive therapy for HSV may be continued indefinitely, without regard for improved CD4 cell count, although need for continuation should be addressed on an annual basis, particularly if immune reconstitution has occurred (**BIII**). In persons starting ART with CD4 cell counts <250 cells/mm³, there is an increased risk of HSV-2 shedding and genital ulcer disease in the first 6 months; suppressive ACV decreases the risk of GUD nearly 60% compared to placebo, and may be recommended for persons with CD4 cell counts <250 cells/mm³ starting ART (**BI**).

Suppressive anti-HSV therapy in persons with HIV infection not on ART also results in a decrease in plasma, anal, and genital secretion HIV RNA levels and in a lower risk of HIV progression.²⁷ However, antiviral regimens for herpes do not decrease the risk of HIV transmission to sexual partners, and should not be used to delay HIV progression in place of ART when ART is available.²⁸ In persons who are taking ART, suppressive HSV antivirals do not impact HIV progression, improve in CD4 T-cell recovery, or decrease markers of systemic inflammation^{29,30} and should not be used for this purpose (**AI**).

The use of daily suppressive therapy (when compared to episodic therapy) has been associated with a lower risk of development of acyclovir-resistant HSV in hematopoietic stem cell recipients;³¹ there are no specific data for persons with HIV infection.

Special Considerations During Pregnancy

Diagnosis of mucocutaneous HSV infections is the same for pregnant women as for non-pregnant women. Episodic therapy for first-episode HSV disease and for recurrences can be offered during pregnancy. Visceral disease during HSV acquisition is more likely to occur during pregnancy and can be fatal. Acyclovir is the antiviral drug with the most reported experience in pregnancy and appears to be safe **(AIII)**.³² The use of valacyclovir and famciclovir during pregnancy has been described and they appear to be safe and well tolerated.³³ Valacyclovir use can be considered for treatment and suppressive therapy during pregnancy because of its simplified dosing schedule **(CIII)**.

An additional concern with HSV during pregnancy is the potential for HSV transmission to the fetus or neonate. The rate of HSV transmission to the newborn in HSV-2-seropositive pregnant women is low, except in those who acquire genital HSV late in pregnancy. The adverse sequelae for the neonate, however, can be very significant. The predominant risk for HSV transmission is maternal genital shedding of HSV at delivery. Cesarean delivery is recommended for women with a genital herpes prodrome or visible HSV genital lesions at the onset of labor **(BII)**.⁸ Use of acyclovir or valacyclovir in late pregnancy suppresses genital herpes outbreaks and reduces the need for cesarean delivery for recurrent HSV in HIV-seronegative women³⁴ and is likely to have similar efficacy in women with HIV infection. However, neonatal HSV disease has been reported in women treated with suppressive antiviral therapy.³⁵ Suppressive therapy with either valacyclovir or acyclovir is recommended starting at 36 weeks' gestation for pregnant women with recurrences of genital herpes during pregnancy **(BII)**.³⁶ Suppressive therapy for women who are only seropositive for HSV-2 without a history of genital lesions is not recommended. Maternal genital herpes was a risk factor for perinatal mother-to-child HIV transmission in the pre-highly active antiretroviral therapy era.³⁷ Whether HSV facilitates HIV transmission among pregnant women on ART is unknown.

Recommendations for Treating Herpes Simplex Virus (HSV) Infections (page 1 of 2)

Treating Orolabial Lesions (Duration: 5–10 days)

- Valacyclovir 1 g PO BID **(AIII)**, *or*
- Famciclovir 500 mg PO BID **(AIII)**, *or*
- Acyclovir 400 mg PO TID **(AIII)**

Treating Initial or Recurrent Genital Lesions (Duration: 5–10 Days)

- Valacyclovir 1 g PO BID **(AI)**, *or*
- Famciclovir 500 mg PO BID **(AI)**, *or*
- Acyclovir 400 mg PO TID **(AI)**

Treating Severe Mucocutaneous HSV Infections (AIII)

- Initial therapy acyclovir 5 mg/kg IV q8h
- After lesions begin to regress, change to oral therapy as above.
- Continue treatment until lesions have completely healed.

Chronic Suppressive Therapy

Indications:

- For patients with severe recurrences **(AI)**, *or*
- Patients who want to minimize the frequency of recurrences **(AI)**, *or*
- To reduce the risk of GUD in patients with CD4 cell counts <250 cells/mm³ who are starting ART **(BI)**

Treatment:

- Valacyclovir 500 mg PO BID **(AI)**, *or*
- Famciclovir 500 mg PO BID **(AI)**, *or*
- Acyclovir 400 mg PO BID **(AI)**
- Evaluate ongoing need for suppressive therapy annually.

Recommendations for Treating Herpes Simplex Virus (HSV) Infections (page 2 of 2)

For Acyclovir-Resistant Mucocutaneous HSV infections

Preferred Therapy:

- Foscarnet 80–120 mg/kg/day IV in 2–3 divided doses until clinical response **(AI)**

Alternative Therapy (Duration: 21–28 days or longer, based on clinical response) **(CIII)**:

- Topical trifluridine, *or*
- Topical cidofovir 1% gel, *or*
- Topical imiquimod 5% cream three times/week, *or*
- IV cidofovir 5 mg/kg IV once weekly

Note:

- Topical formulations of trifluridine and cidofovir are not commercially available.
- Extemporaneous compounding of topical products can be prepared using trifluridine ophthalmic solution and the IV formulation of cidofovir.

Key to Acronyms: BID = twice daily; GUD = genital ulcer disease; HSV = herpes simplex virus; IV = intravenously; PO = orally; TID = three times daily

References

1. Xu F, Sternberg MR, Kottiri BJ, et al. Trends in herpes simplex virus type 1 and type 2 seroprevalence in the United States. *JAMA*. Aug 23 2006;296(8):964-973. Available at <http://www.ncbi.nlm.nih.gov/pubmed/16926356>.
2. Corey L, Wald A, Celum CL, Quinn TC. The effects of herpes simplex virus-2 on HIV-1 acquisition and transmission: a review of two overlapping epidemics. *J Acquir Immune Defic Syndr*. Apr 15 2004;35(5):435-445. Available at <http://www.ncbi.nlm.nih.gov/pubmed/15021308>.
3. Corey L, Adams HG, Brown ZA, Holmes KK. Genital herpes simplex virus infections: clinical manifestations, course, and complications. *Ann Intern Med*. Jun 1983;98(6):958-972. Available at <http://www.ncbi.nlm.nih.gov/pubmed/6344712>.
4. Bissessor M, Fairley CK, Read T, Denham I, Bradshaw C, Chen M. The etiology of infectious proctitis in men who have sex with men differs according to HIV status. *Sex Transm Dis*. Oct 2013;40(10):768-770. Available at <http://www.ncbi.nlm.nih.gov/pubmed/24275725>.
5. Safrin S, Elbeik T, Phan L, et al. Correlation between response to acyclovir and foscarnet therapy and in vitro susceptibility result for isolates of herpes simplex virus from human immunodeficiency virus-infected patients. *Antimicrob Agents Chemother*. Jun 1994;38(6):1246-1250. Available at <http://www.ncbi.nlm.nih.gov/pubmed/8092821>.
6. Yudin MH, Kaul R. Progressive hypertrophic genital herpes in an HIV-infected woman despite immune recovery on antiretroviral therapy. *Infect Dis Obstet Gynecol*. 2008;2008:592532. Available at <http://www.ncbi.nlm.nih.gov/pubmed/18784844>.
7. Sbidian E, Battistella M, Legoff J, et al. Recalcitrant pseudotumoral anogenital herpes simplex virus type 2 in HIV-infected patients: evidence for predominant B-lymphoplasmocytic infiltration and immunomodulators as effective therapeutic strategy. *Clin Infect Dis*. Dec 2013;57(11):1648-1655. Available at <http://www.ncbi.nlm.nih.gov/pubmed/24065320>.
8. Workowski KA, Berman S, Centers for Disease C, Prevention. Sexually transmitted diseases treatment guidelines, 2010. *MMWR Recomm Rep*. Dec 17 2010;59(RR-12):1-110. Available at <http://www.ncbi.nlm.nih.gov/pubmed/21160459>.
9. Workowski KA, Bolan GA, Centers for Disease C, Prevention. Sexually transmitted diseases treatment guidelines, 2015. *MMWR Recomm Rep*. Jun 5 2015;64(RR-03):1-137. Available at <http://www.ncbi.nlm.nih.gov/pubmed/26042815>.
10. Wald A, Krantz E, Selke S, Lairson E, Morrow RA, Zeh J. Knowledge of partners' genital herpes protects against herpes simplex virus type 2 acquisition. *J Infect Dis*. Jul 1 2006;194(1):42-52. Available at <http://www.ncbi.nlm.nih.gov/pubmed/16741881>.
11. Wald A, Langenberg AG, Krantz E, et al. The relationship between condom use and herpes simplex virus acquisition. *Ann Intern Med*. Nov 15 2005;143(10):707-713. Available at <http://www.ncbi.nlm.nih.gov/pubmed/16287791>.
12. Martin ET, Krantz E, Gottlieb SL, et al. A pooled analysis of the effect of condoms in preventing HSV-2 acquisition. *Arch Intern Med*. Jul 13 2009;169(13):1233-1240. Available at <http://www.ncbi.nlm.nih.gov/pubmed/19597073>.

13. Corey L, Wald A, Patel R, et al. Once-daily valacyclovir to reduce the risk of transmission of genital herpes. *N Engl J Med*. Jan 1 2004;350(1):11-20. Available at <http://www.ncbi.nlm.nih.gov/pubmed/14702423>.
14. Mujugira A, Magaret AS, Celum C, et al. Daily acyclovir to decrease herpes simplex virus type 2 (HSV-2) transmission from HSV-2/HIV-1 coinfecting persons: a randomized controlled trial. *J Infect Dis*. Nov 1 2013;208(9):1366-1374. Available at <http://www.ncbi.nlm.nih.gov/pubmed/23901094>.
15. Abdool Karim Q, Abdool Karim SS, Frohlich JA, et al. Effectiveness and safety of tenofovir gel, an antiretroviral microbicide, for the prevention of HIV infection in women. *Science*. Sep 3 2010;329(5996):1168-1174. Available at <http://www.ncbi.nlm.nih.gov/pubmed/20643915>.
16. Celum C, Morrow RA, Donnell D, et al. Daily oral tenofovir and emtricitabine-tenofovir preexposure prophylaxis reduces herpes simplex virus type 2 acquisition among heterosexual HIV-1-uninfected men and women: a subgroup analysis of a randomized trial. *Ann Intern Med*. Jul 1 2014;161(1):11-19. Available at <http://www.ncbi.nlm.nih.gov/pubmed/24979446>.
17. Meyers JD, Wade JC, Mitchell CD, et al. Multicenter collaborative trial of intravenous acyclovir for treatment of mucocutaneous herpes simplex virus infection in the immunocompromised host. *Am J Med*. Jul 20 1982;73(1A):229-235. Available at <http://www.ncbi.nlm.nih.gov/pubmed/7048914>.
18. Posavad CM, Wald A, Kuntz S, et al. Frequent reactivation of herpes simplex virus among HIV-1-infected patients treated with highly active antiretroviral therapy. *J Infect Dis*. Aug 15 2004;190(4):693-696. Available at <http://www.ncbi.nlm.nih.gov/pubmed/15272395>.
19. Bell WR, Chulay JD, Feinberg JE. Manifestations resembling thrombotic microangiopathy in patients with advanced human immunodeficiency virus (HIV) disease in a cytomegalovirus prophylaxis trial (ACTG 204). *Medicine (Baltimore)*. Sep 1997;76(5):369-380. Available at <http://www.ncbi.nlm.nih.gov/pubmed/9352739>.
20. Graham SM, Masese L, Gitau R, et al. Increased risk of genital ulcer disease in women during the first month after initiating antiretroviral therapy. *J Acquir Immune Defic Syndr*. Dec 2009;52(5):600-603. Available at <http://www.ncbi.nlm.nih.gov/pubmed/19648822>.
21. Tobian AA, Grabowski MK, Serwadda D, et al. Reactivation of herpes simplex virus type 2 after initiation of antiretroviral therapy. *J Infect Dis*. Sep 1 2013;208(5):839-846. Available at <http://www.ncbi.nlm.nih.gov/pubmed/23812240>.
22. Couppie P, Sarazin F, Clyti E, et al. Increased incidence of genital herpes after HAART initiation: a frequent presentation of immune reconstitution inflammatory syndrome (IRIS) in HIV-infected patients. *AIDS Patient Care STDS*. Mar 2006;20(3):143-145. Available at <http://www.ncbi.nlm.nih.gov/pubmed/16548710>.
23. Balfour HH, Jr. Antiviral drugs. *N Engl J Med*. Apr 22 1999;340(16):1255-1268. Available at <http://www.ncbi.nlm.nih.gov/pubmed/10210711>.
24. Safrin S, Crumpacker C, Chatis P, et al. A controlled trial comparing foscarnet with vidarabine for acyclovir-resistant mucocutaneous herpes simplex in the acquired immunodeficiency syndrome. The AIDS Clinical Trials Group. *N Engl J Med*. Aug 22 1991;325(8):551-555. Available at <http://www.ncbi.nlm.nih.gov/pubmed/1649971>.
25. Levin MJ, Bacon TH, Leary JJ. Resistance of herpes simplex virus infections to nucleoside analogues in HIV-infected patients. *Clin Infect Dis*. Nov 1 2004;39 Suppl 5:S248-257. Available at <http://www.ncbi.nlm.nih.gov/pubmed/15494896>.
26. DeJesus E, Wald A, Warren T, et al. Valacyclovir for the suppression of recurrent genital herpes in human immunodeficiency virus-infected subjects. *J Infect Dis*. Oct 1 2003;188(7):1009-1016. Available at <http://www.ncbi.nlm.nih.gov/pubmed/14513421>.
27. Lingappa JR, Baeten JM, Wald A, et al. Daily acyclovir for HIV-1 disease progression in people dually infected with HIV-1 and herpes simplex virus type 2: a randomised placebo-controlled trial. *Lancet*. Mar 6 2010;375(9717):824-833. Available at <http://www.ncbi.nlm.nih.gov/pubmed/20153888>.
28. Celum C, Wald A, Lingappa JR, et al. Acyclovir and transmission of HIV-1 from persons infected with HIV-1 and HSV-2. *N Engl J Med*. Feb 4 2010;362(5):427-439. Available at <http://www.ncbi.nlm.nih.gov/pubmed/20089951>.
29. Yi TJ, Walmsley S, Szadkowski L, et al. A randomized controlled pilot trial of valacyclovir for attenuating inflammation and immune activation in HIV/herpes simplex virus 2-coinfecting adults on suppressive antiretroviral therapy. *Clin Infect Dis*. Nov 2013;57(9):1331-1338. Available at <http://www.ncbi.nlm.nih.gov/pubmed/23946220>.
30. Van Wagoner N, Geisler WM, Bachmann LH, Hook EW. The effect of valacyclovir on HIV and HSV-2 in HIV-infected persons on antiretroviral therapy with previously unrecognised HSV-2. *Int J STD AIDS*. Aug 21 2014. Available at <http://www.ncbi.nlm.nih.gov/pubmed/25147236>.

31. Erard V, Wald A, Corey L, Leisenring WM, Boeckh M. Use of long-term suppressive acyclovir after hematopoietic stem-cell transplantation: impact on herpes simplex virus (HSV) disease and drug-resistant HSV disease. *J Infect Dis*. Jul 15 2007;196(2):266-270. Available at <http://www.ncbi.nlm.nih.gov/pubmed/17570114>.
32. Stone KM, Reiff-Eldridge R, White AD, et al. Pregnancy outcomes following systemic prenatal acyclovir exposure: Conclusions from the international acyclovir pregnancy registry, 1984-1999. *Birth Defects Res A Clin Mol Teratol*. Apr 2004;70(4):201-207. Available at <http://www.ncbi.nlm.nih.gov/pubmed/15108247>.
33. Pasternak B, Hviid A. Use of acyclovir, valacyclovir, and famciclovir in the first trimester of pregnancy and the risk of birth defects. *JAMA*. Aug 25 2010;304(8):859-866. Available at <http://www.ncbi.nlm.nih.gov/pubmed/20736469>.
34. Sheffield JS, Hollier LM, Hill JB, Stuart GS, Wendel GD. Acyclovir prophylaxis to prevent herpes simplex virus recurrence at delivery: a systematic review. *Obstet Gynecol*. Dec 2003;102(6):1396-1403. Available at <http://www.ncbi.nlm.nih.gov/pubmed/14662233>.
35. Pinninti SG, Angara R, Feja KN, et al. Neonatal herpes disease following maternal antenatal antiviral suppressive therapy: a multicenter case series. *J Pediatr*. Jul 2012;161(1):134-138 e131-133. Available at <http://www.ncbi.nlm.nih.gov/pubmed/22336576>.
36. Bulletins--Gynecology ACoP. ACOG Practice Bulletin No. 117: Gynecologic care for women with human immunodeficiency virus. *Obstet Gynecol*. Dec 2010;116(6):1492-1509. Available at <http://www.ncbi.nlm.nih.gov/pubmed/21099636>.
37. Chen KT, Segu M, Lumey LH, et al. Genital herpes simplex virus infection and perinatal transmission of human immunodeficiency virus. *Obstet Gynecol*. Dec 2005;106(6):1341-1348. Available at <http://www.ncbi.nlm.nih.gov/pubmed/16319261>.