Introduction

Updated: December 16, 2024
Reviewed: January 8, 2025

Opportunistic infections (OIs), which in the context of HIV have been defined as infections that are more frequent or more severe because of HIV-mediated immunosuppression,[1] were the first clinical manifestations that alerted clinicians to the occurrence of AIDS. *Pneumocystis* pneumonia (PCP), *Toxoplasma* encephalitis, cytomegalovirus retinitis, cryptococcal meningitis, tuberculosis, disseminated *Mycobacterium avium* complex (MAC) disease, and pneumococcal respiratory disease, as well as Kaposi sarcoma and central nervous system lymphoma cancers, have been hallmarks of AIDS. These OIs occurred, on average, 7 to 10 years after infection with HIV.[2,3] Until effective antiretroviral therapy (ART) was developed, patients generally survived only 1 to 2 years after the initial clinical manifestation of AIDS.[4]

Since the late 1980s, the use of chemoprophylaxis, immunization, and better strategies for managing OIs have improved the quality of life and lengthened the survival of people with HIV.[5] Profound reduction in OI-related morbidity and mortality in people with HIV resulted from the introduction of highly effective combination ART in the mid-1990s.[6-12]

Despite the availability and wide use of safe, effective, and simple ART regimens that have led to corresponding population-level declines in the incidence of OIs,[10,13,14] the Centers for Disease Control and Prevention (CDC) estimates that in 2022, 13% of people with HIV in the United States were unaware of their positive HIV status and 43% of Americans with HIV who were aware of their positive HIV status were not effectively virally suppressed (see Figure 14 and Table 5 in the CDC HIV Surveillance report).[15,16] As a result, OIs continue to cause preventable morbidity and mortality in the United States.

Achieving and maintaining durable viral suppression in all people with HIV and preventing or substantially reducing the incidence of HIV-related OIs remains challenging for three main reasons:

- *Not all HIV infections have been diagnosed, and once HIV is diagnosed, many people have already experienced substantial immunosuppression.* The CDC estimates that in 2022, among those with diagnosed HIV, approximately 21% had a CD4 T lymphocyte (CD4) cell count <200 cells/mm^3 (or <14%) at the time of diagnosis (see Figure 2 and Table 1a in the CDC HIV Surveillance report).[15]
- *Not all people with diagnosed HIV receive timely, continuous HIV care or are prescribed ART.* The CDC estimates that in 2022, 82% of people with newly diagnosed HIV had been linked to care within 1 month (see Figure 3 and Table 2a in the CDC HIV Surveillance report). However, only 47% of people with HIV were adequately engaged in continuous care (see Figure 14 in the CDC HIV Surveillance report).[15]
- *Not all people who are treated for HIV achieve durable viral suppression.* The CDC estimates that in 2022, only 65% of people were both engaged in care and had durable viral suppression within 6 months of HIV diagnosis (see Figure 11 in the CDC HIV Surveillance report).[15] Causes for the suboptimal response to treatment include challenges with adherence, unfavorable pharmacokinetics, or unexplained biologic factors.[17]

Thus, some people with HIV will continue to present with an OI as the sentinel event (leading to a diagnosis of HIV) or present with an OI as a complication of unsuccessful viral suppression.[15]

Durable viral suppression eliminates most but not all OIs. Tuberculosis, pneumococcal disease, and dermatomal zoster are examples of infectious diseases that occur at higher incidence in people with HIV regardless of CD4 count. The likelihood of each of these OIs occurring does vary inversely with the CD4 count, however.[18-24] Certain OIs—most notably tuberculosis and syphilis—can increase plasma viral load,[25-29] which both accelerates HIV progression and increases the risk of HIV transmission if patients are not virally suppressed by ART.

Therefore, clinicians continue to need to be knowledgeable about the prevention and management of HIV-related OIs.

History of These Guidelines

In 1989, the Guidelines for Prophylaxis Against *Pneumocystis carinii* Pneumonia for Persons Infected with the Human Immunodeficiency Virus became the first HIV-related treatment guideline published by the U.S. government.[30] This guideline was published in the *Morbidity and Mortality Weekly Report (MMWR)*, which was the most rapid mode of publication at the time. It was followed by a guideline on prevention of MAC disease in 1993.[31] In 1995, these guidelines were expanded to include the treatment of 18 HIV-related OIs. In 2004, information about the prevention of HIV-related OIs was incorporated into the guidelines. The National Institutes of Health (NIH), the HIV Medicine Association (HIVMA), and the Infectious Diseases Society of America (IDSA) jointly co-sponsor these guidelines,[1,32,33] which have been published in peer-reviewed journals and/or the *MMWR* in 1997, 1999, 2002, 2004, and 2009.[33-44] Since 2009, these OI guidelines have been managed as a living document on the web, with each chapter reviewed quarterly by the guidelines committee. Updates are published as often and as promptly as deemed appropriate by the guidelines committee.

In 2023, there were nearly 566,000 online page views and approximately 17,400 PDF downloads, which demonstrate that the Adult and Adolescent OI Guidelines continue to be a valuable resource to clinicians, other health care providers, people with HIV, and policymakers in the United States. Guidelines pertinent to other regions of the world, especially resource-limited countries, may differ with respect to the spectrum of relevant OIs and the diagnostic and therapeutic options that are available to clinicians.

All guideline recommendations related to prevention or treatment are rated based on rigorous criteria that include the quality of supporting evidence. These ratings allow readers to assess the relative importance of each recommendation.

These guidelines address the prevention and treatment of HIV-related OIs in adults and adolescents. Guidelines addressing the prevention and treatment of HIV-related OIs in pediatric populations can be found on the Clinicalinfo website.

Snapshot of Guidelines Development Process

These guidelines were prepared by the Panel on Guidelines for the Prevention and Treatment of Opportunistic Infections in Adults and Adolescents With HIV (the Panel) under the auspices of the Office of AIDS Research Advisory Council (OARAC), an authorized Federal Advisory Committee

to the U.S. Department of Health and Human Services established in 1994. Co-chairs who are selected and appointed by their respective agencies or organizations (i.e., NIH, IDSA, HIVMA) convene OI-specific working groups of clinicians and scientists with subject matter expertise in specific OIs.

The working groups review in real time the relevant literature published since the last review, with the help of quarterly literature searches for articles relevant to their section that are provided by guidelines support staff. The working groups propose revisions to their section as appropriate. The co-chairs, representatives from HIVMA and IDSA, and other Panel working groups with special expertise (e.g., pharmacology, pregnancy) review proposed revisions.

The co-chairs and working group leaders have quarterly teleconferences to discuss section updates. In addition, the co-chairs convene an annual meeting with members of the Panel to discuss guidelines content and strategic planning.

The names and affiliations of all contributors, as well as their financial disclosures, are provided in Appendix B: Panel Roster and Financial Disclosures.

Guidelines Development Process	
Topic	**Comment**
Goal of the guidelines	Provide guidance to HIV care practitioners and others on the optimal prevention and management of HIV-related opportunistic infections (OIs) for adults and adolescents in the United States.
Panel members	The Panel on Guidelines for the Prevention and Treatment of Opportunistic Infections in Adults and Adolescents With HIV (the Panel) is composed of co-chairs who represent the National Institutes of Health (NIH), the HIV Medicine Association (HIVMA), and the Infectious Diseases Society of America (IDSA), plus Panel members with expertise in HIV clinical care, infectious disease management, and research. Co-chairs are selected by their respective agencies or organizations. Each working group is led by a Panel member selected by the co-chairs. Panel members are selected from government, academia, and the health care community by the co-chairs and working group leaders based on the member's area of subject matter expertise. Members serve on the Panel for a 4-year term, with an option to be reappointed for additional terms. Prospective Panel members may self-nominate at any time. When specific or unique subject matter expertise is required, the co-chairs, together with working group leaders, may solicit advice from individuals with such specialized knowledge. The list of the current Panel members can be found in Appendix B: Panel Roster and Financial Disclosures.
Financial disclosure and management of conflicts of interest	All members of the Panel submit a written financial disclosure annually reporting any associations with manufacturers of drugs, vaccines, medical devices, or diagnostics used to manage HIV-related OIs. A list of these disclosures and their last update is available in Appendix B: Panel Roster and Financial Disclosures. The co-chairs review each reported association for potential conflicts of interest and determine the appropriate action: disqualification from the Panel, disqualification or recusal from topic review and discussion, or no disqualification needed. A conflict of interest is defined as any direct financial interest related to a product addressed in the section of the guideline to which a Panel member contributes content. Financial interests include direct receipt by the Panel member of payments, gratuities, consultancies, honoraria, employment, grants, support for travel or accommodation, or gifts from an entity having a commercial interest in that product. Financial interests also include direct compensation for membership on an advisory board, data safety monitoring board, or speakers' bureau. Compensation and support provided to a Panel member's university or institution (e.g., grants, research funding) is not considered a financial conflict of interest. The co-chairs strive to ensure that 50% or more of the members of each working group have no conflicts of interest.
Primary users of the guidelines	HIV treatment providers
Developer	Panel on Guidelines for the Prevention and Treatment of Opportunistic Infections in Adults and Adolescents With HIV, a working group of the Office of AIDS Research Advisory Council (OARAC). See Appendix B: Panel Roster and Financial Disclosures.
Funding source	Office of AIDS Research (OAR), NIH
Evidence collection	The recommendations in the guidelines are based on studies published in peer-reviewed journals. On some occasions, particularly when new information may affect patient safety, unpublished data presented at major conferences or information prepared by the U.S. Food and Drug Administration or manufacturers (e.g., warnings to the public) may be used as evidence to revise the guidelines. Members of each working group are responsible for identifying relevant literature and conducting a systematic comprehensive review of literature that is provided to them on a quarterly basis.

Guidelines Development Process	
Topic	Comment
Method of synthesizing data and formulating recommendations	Each section of the guidelines is assigned to a working group of Panel members with expertise in the area of interest. The members of the working group synthesize the available data. Recommendations are reviewed and updated by each working group after an assessment of the quality and impact of the existing and any new data. Types of evidence that are considered include but are not necessarily limited to case series, prospective cohort trials, and randomized controlled trials, with consideration of the quality and appropriateness of the methods, and the number of participants and effect sizes observed. Finally, all proposed recommendations and supporting evidence are reviewed by the co-chairs before final approval and publication. OAR reviews all proposed recommendations and gives final approval.
Recommendation rating	Recommendations are rated according to the information in the table below, "Rating System for Prevention and Treatment Recommendations," and accompanied, as needed, by explanatory text that reviews the evidence and the working group's assessment. All proposed changes are discussed during teleconferences and by email and then assessed by the Panel's co-chairs and reviewed by OAR, HIVMA, and IDSA before being endorsed as official recommendations.
Other guidelines	These guidelines focus on prevention and treatment of HIV-related OIs for adults and adolescents. A separate guideline outlines similar recommendations for children who have HIV. These guidelines are also available on the Clinicalinfo website.
Update plan	Each working group leader and the co-chairs meet every 3 months by teleconference to review interim data that may warrant modification of the guidelines. Updates may be prompted by approvals of new drugs, vaccines, medical devices, or diagnostics; new information regarding indications or dosing; new safety or efficacy data; or other information that may affect prevention and treatment of HIV-related OIs.

How to Use the Information in These Guidelines

Recommendations in this report address—

- Preventing exposure to opportunistic pathogens;
- Preventing disease;
- Discontinuing primary prophylaxis after immune reconstitution;
- Treating disease;
- When to start ART in the setting of an acute OI;
- Monitoring for adverse effects (including immune reconstitution inflammatory syndrome);
- Managing treatment failure;
- Preventing disease recurrence (secondary prophylaxis or chronic maintenance therapy);
- Discontinuing secondary prophylaxis or chronic maintenance therapy after immune reconstitution; *and*
- Special considerations during pregnancy.

Recommendations are rated according to the criteria in the table below and accompanied, as needed, by explanatory text that reviews the evidence and the working group's assessment. In this system, the letters A, B, or C signify the strength of the recommendation for or against a preventive or therapeutic measure, and the Roman numerals I, II, or III indicate the quality of the evidence supporting the recommendation.

Rating System for Prevention and Treatment Recommendations	
Strength of Recommendation	**Quality of Evidence for the Recommendation**
A: Strong recommendation for the statement B: Moderate recommendation for the statement C: Weak recommendation for the statement	I: One or more randomized trials with clinical outcomes and/or validated laboratory endpoints II: One or more well-designed, non-randomized trials or observational cohort studies with long-term clinical outcomes* III: Expert opinion*

* In cases where there are no data for the prevention or treatment of an opportunistic infection based on studies conducted in people with HIV but there are data derived from studies in people without HIV that could plausibly guide management of patients with HIV, the recommendation is rated II or III but is assigned A, B, or C depending on the strength of the recommendation.

This document also includes tables in each section pertinent to the prevention and treatment of the OI(s) in that section, as well as six summary tables at the end of the document (Tables 1–6).

References

1. Kaplan JE, Masur H, Holmes KK, et al. USPHS/IDSA guidelines for the prevention of opportunistic infections in persons infected with human immunodeficiency virus: an overview. USPHS/IDSA Prevention of Opportunistic Infections Working Group. *Clin Infect Dis*. 1995;21 Suppl 1:S12-31. Available at: https://www.ncbi.nlm.nih.gov/pubmed/8547500.

2. Bacchetti P, Moss AR. Incubation period of AIDS in San Francisco. *Nature*. 1989;338(6212):251-253. Available at: https://www.ncbi.nlm.nih.gov/pubmed/2922052.

3. Alcabes P, Munoz A, Vlahov D, Friedland GH. Incubation period of human immunodeficiency virus. *Epidemiol Rev*. 1993;15(2):303-318. Available at: https://www.ncbi.nlm.nih.gov/pubmed/8174659.

4. Bacchetti P, Osmond D, Chaisson RE, et al. Survival patterns of the first 500 patients with AIDS in San Francisco. *J Infect Dis*. 1988;157(5):1044-1047. Available at: https://www.ncbi.nlm.nih.gov/pubmed/3258900.

5. Detels R, Munoz A, McFarlane G, et al. Effectiveness of potent antiretroviral therapy on time to AIDS and death in men with known HIV infection duration. Multicenter AIDS Cohort Study Investigators. *JAMA*. 1998;280(17):1497-1503. Available at: https://www.ncbi.nlm.nih.gov/pubmed/9809730.

6. Mocroft A, Vella S, Benfield TL, et al. Changing patterns of mortality across Europe in patients infected with HIV-1. EuroSIDA Study Group. *Lancet*. 1998;352(9142):1725-1730. Available at: https://www.ncbi.nlm.nih.gov/pubmed/9848347.

7. McNaghten AD, Hanson DL, Jones JL, Dworkin MS, Ward JW. Effects of antiretroviral therapy and opportunistic illness primary chemoprophylaxis on survival after AIDS diagnosis. Adult/Adolescent Spectrum of Disease Group. *AIDS*. 1999;13(13):1687-1695. Available at: https://www.ncbi.nlm.nih.gov/pubmed/10509570.

8. Miller V, Mocroft A, Reiss P, et al. Relations among CD4 lymphocyte count nadir, antiretroviral therapy, and HIV-1 disease progression: results from the EuroSIDA study. *Ann Intern Med*. 1999;130(7):570-577. Available at: https://www.ncbi.nlm.nih.gov/pubmed/10189326.

9. Mocroft A, Ledergerber B, Katlama C, et al. Decline in the AIDS and death rates in the EuroSIDA study: an observational study. *Lancet*. 2003;362(9377):22-29. Available at: https://www.ncbi.nlm.nih.gov/pubmed/12853195.

10. Buchacz K, Lau B, Jing Y, et al. Incidence of AIDS-defining opportunistic infections in a multicohort analysis of HIV-infected persons in the United States and Canada, 2000–2010. *J Infect Dis*. 2016;214(6):862-872. Available at: https://www.ncbi.nlm.nih.gov/pubmed/27559122.

11. Gardner EM, McLees MP, Steiner JF, Del Rio C, Burman WJ. The spectrum of engagement in HIV care and its relevance to test-and-treat strategies for prevention of HIV infection. *Clin Infect Dis*. 2011;52(6):793-800. Available at: https://www.ncbi.nlm.nih.gov/pubmed/21367734.

12. Ives NJ, Gazzard BG, Easterbrook PJ. The changing pattern of AIDS-defining illnesses with the introduction of highly active antiretroviral therapy (HAART) in a London clinic. *J Infect*. 2001;42(2):134-139. Available at: https://www.ncbi.nlm.nih.gov/pubmed/11531320.

13. Coelho L, Veloso VG, Grinsztejn B, Luz PM. Trends in overall opportunistic illnesses, *Pneumocystis carinii* pneumonia, cerebral toxoplasmosis and *Mycobacterium avium* complex incidence rates over the 30 years of the HIV epidemic: a systematic review. *Braz J Infect Dis*. 2014;18(2):196-210. Available at: https://www.ncbi.nlm.nih.gov/pubmed/24275372.

14. Rubaihayo J, Tumwesigye NM, Konde-Lule J. Trends in prevalence of selected opportunistic infections associated with HIV/AIDS in Uganda. *BMC Infect Dis*. 2015;15:187. Available at: https://www.ncbi.nlm.nih.gov/pubmed/25879621.

15. Centers for Disease Control and Prevention. Monitoring selected national HIV prevention and care objectives by using HIV surveillance data—United States and 6 territories and freely associated states, 2022. *HIV Surveillance Supplemental Report*. 2024;29(2). Available at: https://www.cdc.gov/hiv-data/nhss/national-hiv-prevention-and-care-outcomes.html.

16. Centers for Disease Control and Prevention. Estimated HIV incidence and prevalence in the United States, 2018–2022. *HIV Surveillance Supplemental Report*. 2024;29(1). Available at: https://www.cdc.gov/hiv-data/nhss/estimated-hiv-incidence-and-prevalence.html.

17. Kelly C, Gaskell KM, Richardson M, Klein N, Garner P, MacPherson P. Discordant immune response with antiretroviral therapy in HIV-1: a systematic review of clinical outcomes. *PLoS One*. 2016;11(6):e0156099. Available at: https://www.ncbi.nlm.nih.gov/pubmed/27284683.

18. Sonnenberg P, Glynn JR, Fielding K, Murray J, Godfrey-Faussett P, Shearer S. How soon after infection with HIV does the risk of tuberculosis start to increase? A retrospective cohort study in South African gold miners. *J Infect Dis*. 2005;191(2):150-158. Available at: https://www.ncbi.nlm.nih.gov/pubmed/15609223.

19. Wood R, Maartens G, Lombard CJ. Risk factors for developing tuberculosis in HIV-1-infected adults from communities with a low or very high incidence of tuberculosis. *J Acquir Immune Defic Syndr*. 2000;23(1):75-80. Available at: https://www.ncbi.nlm.nih.gov/pubmed/10708059.

20. Wallace JM, Hansen NI, Lavange L, et al. Respiratory disease trends in the Pulmonary Complications of HIV Infection Study cohort. Pulmonary Complications of HIV Infection Study Group. *Am J Respir Crit Care Med*. 1997;155(1):72-80. Available at: https://www.ncbi.nlm.nih.gov/pubmed/9001292.

21. Hirschtick RE, Glassroth J, Jordan MC, et al. Bacterial pneumonia in persons infected with the human immunodeficiency virus. Pulmonary Complications of HIV Infection Study Group. *N Engl J Med*. 1995;333(13):845-851. Available at: https://www.ncbi.nlm.nih.gov/pubmed/7651475.

22. Engels EA, Rosenberg PS, Biggar RJ. Zoster incidence in human immunodeficiency virus-infected hemophiliacs and homosexual men, 1984–1997. District of Columbia Gay Cohort Study. Multicenter Hemophilia Cohort Study. *J Infect Dis*. 1999;180(6):1784-1789. Available at: https://www.ncbi.nlm.nih.gov/pubmed/10558932.

23. Gebo KA, Kalyani R, Moore RD, Polydefkis MJ. The incidence of, risk factors for, and sequelae of herpes zoster among HIV patients in the highly active antiretroviral therapy era. *J Acquir Immune Defic Syndr*. 2005;40(2):169-174. Available at: https://www.ncbi.nlm.nih.gov/pubmed/16186734.

24. Vanhems P, Voisin L, Gayet-Ageron A, et al. The incidence of herpes zoster is less likely than other opportunistic infections to be reduced by highly active antiretroviral therapy. *J Acquir Immune Defic Syndr*. 2005;38(1):111-113. Available at: https://www.ncbi.nlm.nih.gov/pubmed/15608535.

25. Toossi Z, Mayanja-Kizza H, Hirsch CS, et al. Impact of tuberculosis (TB) on HIV-1 activity in dually infected patients. *Clin Exp Immunol*. 2001;123(2):233-238. Available at: https://www.ncbi.nlm.nih.gov/pubmed/11207653.

26. Sadiq ST, McSorley J, Copas AJ, et al. The effects of early syphilis on CD4 counts and HIV-1 RNA viral loads in blood and semen. *Sex Transm Infect*. 2005;81(5):380-385. Available at: https://www.ncbi.nlm.nih.gov/pubmed/16199736.

27. Bentwich Z. Concurrent infections that rise the HIV viral load. *J HIV Ther*. 2003;8(3):72-75. Available at: https://www.ncbi.nlm.nih.gov/pubmed/12951545.

28. Kublin JG, Patnaik P, Jere CS, et al. Effect of *Plasmodium falciparum* malaria on concentration of HIV-1-RNA in the blood of adults in rural Malawi: a prospective cohort study. *Lancet*. 2005;365(9455):233-240. Available at: https://www.ncbi.nlm.nih.gov/pubmed/15652606.

29. Abu-Raddad LJ, Patnaik P, Kublin JG. Dual infection with HIV and malaria fuels the spread of both diseases in sub-Saharan Africa. *Science*. 2006;314(5805):1603-1606. Available at: https://www.ncbi.nlm.nih.gov/pubmed/17158329.

30. Centers for Disease Control and Prevention. Guidelines for prophylaxis against *Pneumocystis carinii* pneumonia for persons infected with human immunodeficiency virus. *MMWR Suppl*. 1989;38(5):1-9. Available at: https://www.ncbi.nlm.nih.gov/pubmed/2524643.

31. Masur H. Recommendations on prophylaxis and therapy for disseminated *Mycobacterium avium* complex disease in patients infected with the human immunodeficiency virus. Public Health Service Task Force on Prophylaxis and Therapy for *Mycobacterium avium* Complex. *N Engl J Med*. 1993;329(12):898-904. Available at: https://www.ncbi.nlm.nih.gov/pubmed/8395019.

32. USPHS/IDSA guidelines for the prevention of opportunistic infections in persons infected with human immunodeficiency virus: a summary. *MMWR Recomm Rep*. 1995;44(RR-8):1-34. Available at: https://www.ncbi.nlm.nih.gov/pubmed/7565547.

33. USPHS/IDSA guidelines for the prevention of opportunistic infections in persons infected with human immunodeficiency virus: disease-specific recommendations. USPHS/IDSA Prevention of Opportunistic Infections Working Group. *Clin Infect Dis*. 1995;21 Suppl 1:S32-43. Available at: https://www.ncbi.nlm.nih.gov/pubmed/8547510.

34. 1997 USPHS/IDSA guidelines for the prevention of opportunistic infections in persons infected with HIV: part I. prevention of exposure. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention. *Am Fam Physician*. 1997;56(3):823-834. Available at: https://www.ncbi.nlm.nih.gov/pubmed/9301575.

35. 1999 USPHS/IDSA guidelines for the prevention of opportunistic infections in persons infected with human immunodeficiency virus. U.S. Public Health Service (USPHS) and Infectious Diseases Society of America (IDSA). *MMWR Recomm Rep*. 1999;48(RR-10):1-59, 61-56. Available at: https://www.ncbi.nlm.nih.gov/pubmed/10499670.

36. Kaplan JE, Masur H, Holmes KK, U.S. Public Health Service, Infectious Disease Society of America. Guidelines for preventing opportunistic infections among HIV-infected persons—2002. Recommendations of the U.S. Public Health Service and the Infectious Diseases Society of America. *MMWR Recomm Rep*. 2002;51(RR-8):1-52. Available at: https://www.ncbi.nlm.nih.gov/pubmed/12081007.

37. Kaplan JE, Masur H, Jaffe HW, Holmes KK. Preventing opportunistic infections in persons infected with HIV: 1997 guidelines. *JAMA*. 1997;278(4):337-338. Available at: https://www.ncbi.nlm.nih.gov/pubmed/9228443.

38. 1999 USPHS/IDSA guidelines for the prevention of opportunistic infections in persons infected with human immunodeficiency virus. *Clin Infect Dis*. 2000;30 Suppl 1:S29-65. Available at: https://www.ncbi.nlm.nih.gov/pubmed/10770913.

39. USPHS/IDSA guidelines for the prevention of opportunistic infections in persons infected with human immunodeficiency virus: a summary. *Ann Intern Med*. 1996;124(3):349-368. Available at: https://www.ncbi.nlm.nih.gov/pubmed/8554235.

40. 1997 USPHS/IDSA guidelines for the prevention of opportunistic infections in persons infected with human immunodeficiency virus. *Ann Intern Med*. 1997;127(10):922-946. Available at: https://www.ncbi.nlm.nih.gov/pubmed/9382373.

41. 1999 USPHS/IDSA guidelines for the prevention of opportunistic infections in persons infected with HIV: part I. prevention of exposure. *Am Fam Physician*. 2000;61(1):163-174. Available at: https://www.ncbi.nlm.nih.gov/pubmed/10643957.

42. Benson CA, Kaplan JE, Masur H, et al. Treating opportunistic infections among HIV-infected adults and adolescents: recommendations from CDC, the National Institutes of Health, and the HIV Medicine Association/Infectious Diseases Society of America. *MMWR Recomm Rep*. 2004;53(RR-15):1-112. Available at: https://www.ncbi.nlm.nih.gov/pubmed/15841069.

43. Kaplan JE, Benson C, Holmes KK, et al. Guidelines for prevention and treatment of opportunistic infections in HIV-infected adults and adolescents: recommendations from CDC, the National Institutes of Health, and the HIV Medicine Association of the Infectious Diseases Society of America. *MMWR Recomm Rep*. 2009;58(RR-4):1-207; quiz CE201-204. Available at: https://www.ncbi.nlm.nih.gov/pubmed/19357635.

44. Mofenson LM, Brady MT, Danner SP, et al. Guidelines for the Prevention and Treatment of Opportunistic Infections among HIV-exposed and HIV-infected children: recommendations from CDC, the National Institutes of Health, the HIV Medicine Association of the Infectious Diseases Society of America, the Pediatric Infectious Diseases Society, and the American Academy of Pediatrics. *MMWR Recomm Rep*. 2009;58(RR-11):1-166. Available at: https://www.ncbi.nlm.nih.gov/pubmed/19730409.