

Guidelines for the Prevention and Treatment of Opportunistic Infections in Adults and Adolescents With HIV



Developed by the National Institutes of Health, the HIV Medicine Association, and the Infectious Diseases Society of America Panel on Guidelines for the Prevention and Treatment of Opportunistic Infections in Adults and Adolescents With HIV—A Working Group of the NIH Office of AIDS Research Advisory Council (OARAC)

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It is emphasized that concepts relevant to HIV management evolve rapidly. The Panels have a mechanism to update recommendations on a regular basis, and the most recent information is available on the Clinicalinfo website (<https://clinicalinfo.hiv.gov/>).

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Table 1. Chemoprophylaxis to Prevent First Episode of Opportunistic Disease

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This table provides recommendations for the use of chemoprophylaxis to prevent the first episode of opportunistic disease. For the use of immunizations to prevent certain infections in people with HIV, please refer to the [Immunizations for Preventable Diseases in Adults and Adolescents With HIV](#) section.

Opportunistic Infections	Indication	Preferred	Alternative
Coccidioidomycosis	A new positive <i>Coccidioides</i> IgM or IgG test in patients who previously tested negative; do not have signs, symptoms, or laboratory abnormalities compatible with active disease; and have CD4 count <250 cells/mm ³ (AIII)	Fluconazole 400 mg PO daily (AIII)	None
Cystoisosporiasis	CD4 count <200 cells/mm ³ and living in or traveling to regions endemic for <i>Cystoisospora belli</i> (CII)	TMP-SMX (160 mg/800 mg) PO three times weekly (AI), or TMP-SMX (160 mg/800 mg) PO daily (AI)	None
<i>Histoplasma capsulatum</i> Infection	CD4 count <150 cells/mm ³ and at high risk because of occupational exposure or living in a community with a hyperendemic rate of histoplasmosis (>10 cases per 100 person-years) (BI)	Itraconazole 200 mg PO daily (BI)	None
Malaria	Travel to disease-endemic area	Recommendations are the same as for people without HIV. Recommendations are based on the region of travel, malaria risks, and drug susceptibility in the region. Refer to the CDC's Yellow Book for the most recent recommendations based on region and drug susceptibility.	None

Table 1. Chemoprophylaxis to Prevent First Episode of Opportunistic Disease

Opportunistic Infections	Indication	Preferred	Alternative
<i>Mycobacterium avium</i> Complex (MAC) Disease	<p>CD4 count <50 cells/mm³ AND not receiving ART, or remains viremic on ART, or has no options for a fully suppressive ART regimen (AI)</p> <p>Not recommended for those who immediately initiate ART after HIV diagnosis (AII)</p> <p>Disseminated MAC disease should be ruled out before starting primary prophylaxis. See the MAC section for more information.</p>	<p>Azithromycin 1,200 mg PO once weekly (AI), <i>or</i></p> <p>Clarithromycin 500 mg PO twice daily (AI), <i>or</i></p> <p>Azithromycin 600 mg PO twice weekly (BIII)</p>	<p>Rifabutin (dose adjustment may be necessary with some ARV drugs, and rifabutin is not recommended if used with certain ARV drugs)^a (BI); rule out active TB before starting rifabutin to avoid monotherapy in the setting of TB.</p> <p>For information on drug–drug interactions between antimycobacterial agents (e.g. clarithromycin and rifabutin) and concomitant ARVs, refer to the Liverpool HIV Drug Interaction Checker.</p>
<i>Mycobacterium tuberculosis</i> Infection (TB) (i.e., treatment of latent TB infection [LTBI])	<p>Positive screening test for LTBI,^b no evidence of active TB, and no prior treatment for active TB or LTBI (AI), <i>or</i></p> <p>Close contact with a person with infectious TB (with no evidence of active TB), regardless of screening test results and CD4 count (AII)</p> <p>For recommendations on management of drug interactions with ARVs, see the Dosing Recommendations for Use of ARV and Anti-TB Drugs When Treating Latent TB Infection table in the <i>Mycobacterium tuberculosis</i> Infection and Disease section and the Drug–Drug Interactions in the Adult and Adolescent Antiretroviral Guidelines.</p>	<p>3HP</p> <p>Rifapentine (see weight-based dosing below) plus INH 15 mg/kg (900 mg maximum) plus pyridoxine 50 mg PO once weekly for 12 weeks (AI)</p> <p><i>Weight-Based Rifapentine Dose</i></p> <ul style="list-style-type: none"> • Weighing 25.1–32 kg: 600 mg PO once weekly • Weighing 32.1–49.9 kg: 750 mg PO once weekly • Weighing >50 kg: 900 mg PO once weekly <p>Note: 3HP is recommended only for virally suppressed persons receiving EFV, RAL, or once daily DTG-based ARV regimen (AII).</p> <p><i>or</i></p> <p>3HR</p> <p>INH 300 mg plus rifampin 600 mg plus pyridoxine 25–50 mg PO daily for 3 months (AI)</p>	<p>INH 300 mg plus pyridoxine 25–50 mg PO daily for 6–9 months (AII), <i>or</i></p> <p>4R: Rifampin 600 mg PO daily for 4 months (BI), <i>or</i></p> <p>1HP: Rifapentine (see weight-based dosing below) plus INH 300 mg plus pyridoxine 25–50 mg PO once daily for 4 weeks (BI)</p> <p><i>Weight-Based Rifapentine Dose</i></p> <ul style="list-style-type: none"> • <i>Weighing</i> <35 kg: 300 mg PO once daily • <i>Weighing</i> 35–45 kg: 450 mg PO once daily • <i>Weighing</i> >45 kg: 600 mg PO once daily <p>Note: 1HP is recommended only for patients receiving an efavirenz-based ARV regimen (AI).</p> <p>For persons exposed to drug-resistant TB, select anti-TB drugs after consultation with experts and public health authorities (AIII).</p>

Table 1. Chemoprophylaxis to Prevent First Episode of Opportunistic Disease

Opportunistic Infections	Indication	Preferred	Alternative
<i>Pneumocystis</i> Pneumonia (PCP)	<p>Individuals not on ART or starting ART with CD4 count <200 cells/mm³ (AI)</p> <p>Individuals currently on ART with either—</p> <ul style="list-style-type: none"> • CD4 count <100 cells/mm³ regardless of HIV RNA (AIII), or • CD4 count 100–200 cells/mm³ and HIV RNA consistently above the detection limit of the assay used (AIII) <p>Note: Patients who are receiving pyrimethamine/sulfadiazine for treatment or suppression of toxoplasmosis do not require additional PCP prophylaxis (AII).</p>	<p>TMP-SMX 1 DS tablet PO daily (AI), or</p> <p>TMP-SMX 1 SS tablet PO daily (AI)</p> <p>Note: TMP-SMX also confers protection against toxoplasmosis and some protection against many respiratory bacterial infections.</p>	<p>The following regimens can be used regardless of whether the person is seropositive or seronegative for <i>Toxoplasma gondii</i>:</p> <ul style="list-style-type: none"> • TMP-SMX 1 DS PO three times weekly (BI), or • Dapsone^c 50 mg PO daily with pyrimethamine^d 50 mg plus leucovorin 25 mg PO weekly (BI), or • Dapsone^c 200 mg plus pyrimethamine^d 75 mg plus leucovorin 25 mg PO weekly (BI), or • Atovaquone 1,500 mg PO daily with food (BI) <p>The following regimens should only be used if the person is seronegative for <i>Toxoplasma gondii</i>:</p> <ul style="list-style-type: none"> • Dapsone^c 100 mg PO daily or 50 mg PO twice daily (BI), or • Aerosolized pentamidine 300 mg via Respigard II nebulizer every month (BI), or • IV pentamidine 300 mg every 28 days (CIII)
Syphilis	<p>Presumptive treatment is indicated if a sex partner is diagnosed with primary, secondary, or early latent syphilis.</p> <ul style="list-style-type: none"> • Individuals sexually exposed ≤90 days before the partner's diagnosis should be presumptively treated for early syphilis, regardless of syphilis serologic status (AII). • Individuals sexually exposed >90 days before the partner's diagnosis should be presumptively treated if syphilis serologic test results are not available immediately and the opportunity for follow-up is uncertain (AIII). 	<p>Benzathine penicillin G 2.4 million units IM for one dose (AII)</p>	<ul style="list-style-type: none"> • Doxycycline 100 mg PO twice daily for 14 days (BII), or • Ceftriaxone 1 g IM or IV daily for 10–14 days (BII) <p>For patients allergic to penicillin:</p> <ul style="list-style-type: none"> • People with penicillin allergy whose adherence or follow-up cannot be ensured should be desensitized and treated with benzathine penicillin G (AIII). • Note: Skin testing for penicillin allergy can be useful, if available. See Syphilis for details.

Table 1. Chemoprophylaxis to Prevent First Episode of Opportunistic Disease

Opportunistic Infections	Indication	Preferred	Alternative
Talaromycosis (Penicilliosis)	<p>People with (1) CD4 cell counts <100 cells/mm³ and who are not taking ART or have treatment failure without access to effective ART options or (2) CD4 counts ≥100 cells/mm³ but have a condition that suppresses T-cell function, AND who either—</p> <ul style="list-style-type: none"> Reside in the hyperendemic regions in northern Thailand, throughout Vietnam, or in southern China (particularly in highland regions during the rainy humid months) (BI) or Are from countries outside of the hyperendemic region and must travel to the region (BIII) 	<p>For people who reside in hyperendemic areas:</p> <ul style="list-style-type: none"> Itraconazole 200 mg PO once daily (BI) <p>For those traveling to the hyperendemic regions:</p> <ul style="list-style-type: none"> Begin itraconazole 200 mg PO once daily 3 days before travel and continue for 1 week after leaving the hyperendemic area (BIII). 	<p>For people who reside in hyperendemic areas:</p> <ul style="list-style-type: none"> Fluconazole 400 mg PO once weekly (BII) <p>For those traveling to the hyperendemic regions:</p> <ul style="list-style-type: none"> Take the first dose of fluconazole 400 mg 3 days before travel, continue 400 mg once weekly, and take the final dose after leaving the hyperendemic area (BIII).
<i>Toxoplasma gondii</i> Encephalitis	<p><i>Toxoplasma</i> IgG-positive patients with CD4 count <100 cells/mm³ (All)</p> <p>Note: All regimens recommended for primary prophylaxis against toxoplasmosis also are effective as PCP prophylaxis.</p>	TMP-SMX 1 DS PO daily (All)	<p>TMP-SMX 1 DS PO three times weekly (BII), or</p> <p>TMP-SMX 1 SS PO daily (BIII), or</p> <p>Dapsone^c 50 mg PO daily plus (pyrimethamine^d 50 mg plus leucovorin 25 mg) PO weekly (BI), or</p> <p>(Dapsone 200 mg plus pyrimethamine^d 75 mg plus leucovorin 25 mg) PO weekly (CI), or</p> <p>Atovaquone 1,500 mg PO daily (CIII), or</p> <p>(Atovaquone 1,500 mg plus pyrimethamine^d 25 mg plus leucovorin 10 mg) PO daily (CIII)</p>

^a Refer to the [Dosing Recommendations for Use of ARV and Anti-TB Drugs for Treatment of Active Drug Sensitive TB](#) table in the *Mycobacterium tuberculosis* section for dosing recommendations.

^b Screening tests for latent tuberculosis infection include tuberculin skin tests and interferon-gamma release assays.

^c Patients should be tested for glucose-6-phosphate dehydrogenase (G6PD) before administration of dapsone. An alternative agent should be used in patients found to have G6PD deficiency.

^d Refer to [Daraprim Direct](#) for information regarding how to access pyrimethamine.

For information regarding the evidence ratings, refer to the [Rating System for Prevention and Treatment Recommendations](#) in the Introduction section of the Adult and Adolescent Opportunistic Infection Guidelines.

Key: ART = antiretroviral therapy; ARV = antiretroviral; CD4 = CD4 T lymphocyte; CDC = Centers for Disease Control and Prevention; DS = double strength; DTG = dolutegravir; EFV = efavirenz; IgG = immunoglobulin G; IgM = immunoglobulin M; IM = intramuscular; INH = isoniazid; IV = intravenous; LTBI = latent tuberculosis infection; MAC = *Mycobacterium avium* complex; PCP = *Pneumocystis pneumonia*; PO = orally; RAL = raltegravir; SS = single strength; TB = tuberculosis; TMP-SMX = trimethoprim-sulfamethoxazole

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

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Opportunistic Infection		Preferred Therapy	Alternative Therapy	Other Comments
Bacterial Enteric Infections	Empiric Therapy Pending Definitive Diagnosis	<p>For People With HIV and CD4 Count >500 Cells/mm³, 1–2 Days of Loose Stool Without Fever or Blood in Stool</p> <ul style="list-style-type: none"> • Oral hydration, no further workup, and no antibiotics <p>For People With HIV and CD4 Count 200–500 Cells/mm³ With Diarrhea Severe Enough to Compromise Quality of Life or the Ability to Work</p> <ul style="list-style-type: none"> • Azithromycin 500 mg PO daily for 5 days (BIII), or • Ciprofloxacin 500–750 mg PO every 12 hours for 5 days (BIII) <p>For People With HIV and Severe Disease (e.g., CD4 Count <200 Cells/mm³ or Concomitant AIDS-Defining Illness and With Clinically Severe Diarrhea [≥ 6 Liquid Stools Per Day or Bloody Stool and/or Accompanying Fever or Chills])</p> <ul style="list-style-type: none"> • Hospitalization for diagnostic evaluation and IV antibiotics • Ceftriaxone IV 1–2 g every 24 hours (BIII) <p>Note: If <i>Campylobacter</i> or <i>Shigella</i> bacteremia is suspected, a carbapenem is preferred (BIII).</p> <p>Therapy and duration should be adjusted based on microbiology and antibiotic sensitivity results.</p> <p>If no pathogen is identified and the patient recovers quickly, 5 days of therapy is recommended.</p>		<p>Diagnostic fecal specimens should be obtained before initiation of empiric antimicrobial therapy.</p> <p>If a pathogen is identified, antibiotic susceptibilities should be performed to confirm and inform antibiotic choices, given increased reports of antibiotic resistance.</p> <p>Oral or IV rehydration (if indicated) should be given to patients with diarrhea (AIII).</p> <p>Antimotility agents should be avoided if there is concern about inflammatory diarrhea, including CDI (BIII).</p> <p>Risk of bacteremia increases with decreasing CD4 count.</p> <p>If no clinical response is observed after 3–4 days, consider a follow-up stool culture with antibiotic susceptibility testing or alternative diagnostic tests (e.g., toxin assays, molecular testing) to evaluate alternative diagnoses, antibiotic resistance, or drug–drug interaction (BIII).</p> <p>MSM may be at increased risk for antibiotic-resistant enteric infections.</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection		Preferred Therapy	Alternative Therapy	Other Comments
		For patients with persistent diarrhea (>14 days) without severe clinical signs, antibiotics therapy can be withheld until a diagnosis is made.		
	Campylobacteriosis	<p>For Mild Disease If CD4 Count >200 Cells/mm³</p> <ul style="list-style-type: none"> No therapy unless symptoms persist for more than several days (CIII) <p>For Mild to Moderate Disease (If Susceptible)</p> <ul style="list-style-type: none"> Azithromycin 500 mg PO daily for 5 days (BIII) (not recommended for patients with bacteremia [AIII]), or Ciprofloxacin 500–750 mg PO (or 400 mg IV) every 12 hours for 7–10 days (BIII) <p>For <i>Campylobacter</i> Bacteremia</p> <ul style="list-style-type: none"> Ciprofloxacin 500–750 mg PO (or 400 mg IV) every 12 hours for ≥14 days if the isolate is sensitive (BIII) plus an aminoglycoside (BIII) to limit the emergence of antibiotic resistance <p>For Recurrent Infections</p> <ul style="list-style-type: none"> Duration of therapy may be extended to 2–6 weeks (BIII). 	<p>For Mild to Moderate Disease (If Susceptible)</p> <ul style="list-style-type: none"> Levofloxacin 750 mg (PO or IV) every 24 hours (BIII) Add an aminoglycoside to fluoroquinolone in bacteremic patients (BIII) to limit the emergence of antibiotic resistance. 	<p>Oral or IV rehydration if indicated (AIII)</p> <p>Antimotility agents should be avoided (BIII).</p> <p>Third-generation cephalosporins are not reliably active, and use of alternative cell wall-active agents, such as carbapenems, may be necessary in severely ill people who require empiric IV therapy until antimicrobial susceptibilities return.</p> <p>In the United States in 2018, 29% of <i>C. jejuni</i> isolates were resistant to ciprofloxacin and 2% were resistant to azithromycin; among <i>C. coli</i> isolates, 40.5% were resistant to fluoroquinolone and 13.3% were resistant to azithromycin.</p> <p>Effective ART may reduce the frequency, severity, and recurrence of <i>Campylobacter</i> infections.</p>
	<i>Clostridium difficile</i> Infection (CDI)	<p>For Severe or Non-severe CDI</p> <ul style="list-style-type: none"> Fidaxomicin 200 mg PO twice daily for 10 days (AI) <p>For Recurrent CDI</p> <ul style="list-style-type: none"> 2021 IDSA CDI Guidelines suggest use of fidaxomicin over oral vancomycin because it has a greater likelihood for a sustained clinical response at 30 days (AI). 	<p>For Severe or Non-severe CDI</p> <ul style="list-style-type: none"> Vancomycin 125 mg PO four times daily for 10 days (AI) <p>For Non-severe CDI</p> <p><i>If Neither Fidaxomicin nor Vancomycin Is Available</i></p> <ul style="list-style-type: none"> Metronidazole 500 mg (PO) three times daily for 10 days (CI) 	<p>Severe CDI: white blood cell count ≥15,000 cells/mL or serum creatinine concentrations >1.5 mg/dL; non-severe CDI: white blood cell count <15,000 cells/mL and serum creatinine concentrations <1.5 mg/dL</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection		Preferred Therapy	Alternative Therapy	Other Comments
			<p>Recurrent CDI</p> <ul style="list-style-type: none"> • Vancomycin is an acceptable option (see IDSA Guideline for tapered and pulsed regimens) (AI). • For patients with CD4 counts >200 cells/mm³, FMT may be considered after three CDI episodes (i.e., an initial and two recurrent episodes) (CIII). 	
	Salmonellosis	<p>All people with HIV and salmonellosis should receive antimicrobial treatment due to an increase of bacteremia (by 20-fold to 100-fold) and mortality (by up to sevenfold) compared with individuals without HIV (AIII).</p> <p>For Invasive Disease (Suspected or Confirmed)</p> <ul style="list-style-type: none"> • Ceftriaxone IV 1–2 g every 24 hours pending susceptibilities (BIII) <p>For Nontyphoidal Salmonella Gastroenteritis (With or Without Bacteremia) (If Susceptible)</p> <ul style="list-style-type: none"> • Ciprofloxacin 500–750 mg PO (or 400 mg IV) every 12 hours (AIII) <p>Duration of Therapy</p> <p><i>For Gastroenteritis Without Bacteremia</i></p> <ul style="list-style-type: none"> • If CD4 count ≥200 cells/mm³: 7–14 days (BIII) • If CD4 count <200 cells/mm³: minimum of 2 weeks (may extend to up to 6 weeks if with severe disease) (BIII) <p><i>For Gastroenteritis With Bacteremia</i></p> <ul style="list-style-type: none"> • If CD4 count ≥200/mm³: 14 days or longer duration if bacteremia persists or if the infection is complicated (e.g., if metastatic foci of infection are present) (BIII) 	<p>For Nontyphoidal Salmonella Gastroenteritis (With or Without Bacteremia) (If Susceptible)</p> <ul style="list-style-type: none"> • Levofloxacin 750 mg (PO or IV) every 24 hours (BIII), or • Moxifloxacin 400 mg (PO or IV) every 24 hours (BIII), or • TMP-SMX (160 mg/800 mg) PO (or IV) every 12 hours (BIII), or • Ceftriaxone 1–2 g IV every 24 hours (BIII) 	<p>Oral or IV rehydration if indicated (AIII)</p> <p>Antimotility agents should be avoided (BIII).</p> <p>The role of long-term secondary prophylaxis in patients with recurrent <i>Salmonella</i> bacteremia is not well established. Must weigh the benefits against the risks of long-term antibiotic exposure (BIII).</p> <p>Effective ART may reduce the frequency, severity, and recurrence of salmonella infections.</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection		Preferred Therapy	Alternative Therapy	Other Comments
		<ul style="list-style-type: none"> If CD4 count <200 cells/mm³: 2–6 weeks (BIII) <p>Secondary Prophylaxis Should Be Considered for Patients With—</p> <ul style="list-style-type: none"> Recurrent <i>Salmonella</i> bacteremia (BIII), or Recurrent gastroenteritis (with or without bacteremia) with CD4 count <200 cells/mm³ with severe diarrhea (BIII) 		
	Shigellosis	<ul style="list-style-type: none"> Ciprofloxacin 500–750 mg PO (or 400 mg IV) every 12 hours (if MIC <0.12 mcg/mL) (AIII) <p>Duration of Therapy</p> <ul style="list-style-type: none"> Gastroenteritis: 5–7 days (AIII) (except ciprofloxacin [5–10 days] and azithromycin [5 days]) Bacteremia: ≥14 days (BIII) Recurrent infections: Up to 6 weeks (BIII) <p><i>In Severely Ill Patients Requiring Empiric Parenteral Therapy While Awaiting Susceptibility</i></p> <ul style="list-style-type: none"> Consider initiating a carbapenem until antimicrobial susceptibilities are available (BIII). <p>Note: Increased resistance of <i>Shigella</i> to fluoroquinolones in the United States. Alternative antibiotics should be considered if ciprofloxacin MIC is ≥0.12 mcg/mL (BIII).</p>	<ul style="list-style-type: none"> Levofloxacin 750 mg (PO or IV) every 24 hours (BIII), or Trimethoprim 160 mg/sulfamethoxazole 800 mg PO or IV every 12 hours for 5–7 days (BIII), or Azithromycin 500 mg PO daily for 5 days (BIII), or Ceftriaxone 1–2 g IV every 24 hours (BIII) <p>Note: Azithromycin and TMP-SMX are not recommended for treatment of bacteremia.</p> <p>Note: Azithromycin-resistant <i>Shigella</i> spp. have been reported in MSM with HIV.</p>	<p>Therapy may slightly shorten the duration of illness and/or prevent the spread of infection (AIII).</p> <p>Oral or IV rehydration if indicated (AIII)</p> <p>Antimotility agents should be avoided (BIII).</p> <p>Many <i>Shigella</i> strains that are resistant to fluoroquinolones exhibit resistance to other commonly used antibiotics. Antibiotic sensitivity testing of <i>Shigella</i> isolates from individuals with HIV should be performed routinely.</p> <p>Given increasing antimicrobial resistance and limited data showing that antibiotic therapy limits transmission, antibiotic treatment may be withheld in patients with CD4 count >500 cells/mm³ whose diarrhea resolves prior to culture confirmation of <i>Shigella</i> infection (CIII).</p> <p>Effective ART may decrease the risk of recurrence of <i>Shigella</i> infections.</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
Bartonellosis	<p>For Bacillary Angiomatosis, Peliosis Hepatis, Bacteremia, and Osteomyelitis</p> <ul style="list-style-type: none"> • Doxycycline 100 mg PO or IV every 12 hours (AII), or • Erythromycin 500 mg PO or IV every 6 hours (AII) <p>CNS Infections</p> <ul style="list-style-type: none"> • (Doxycycline 100 mg +/- RIF 300 mg) PO or IV every 12 hours (AIII) <p>Confirmed <i>Bartonella</i> Endocarditis</p> <ul style="list-style-type: none"> • (Doxycycline 100 mg IV plus RIF 300 mg PO or IV) every 12 hours for 6 weeks, then continue with doxycycline 100 mg IV or PO every 12 hours (BII) <p>Other Severe Infections</p> <ul style="list-style-type: none"> • (Doxycycline 100 mg PO or IV +/- RIF 300 mg PO or IV) every 12 hours (BIII), or • (Erythromycin 500 mg PO or IV every 6 hours) +/- RIF 300 mg PO or IV every 12 hours (BIII) <p>Duration of Therapy</p> <ul style="list-style-type: none"> • At least 3 months (AII) 	<p>For Bacillary Angiomatosis, Peliosis Hepatis, Bacteremia, Osteomyelitis, and Other Severe Infection</p> <ul style="list-style-type: none"> • Azithromycin 500 mg PO daily (BIII) • Clarithromycin 500 mg PO twice a day (BIII) <p>Confirmed <i>Bartonella</i> Endocarditis</p> <ul style="list-style-type: none"> • (Doxycycline 100 mg IV every 12 hours plus gentamicin 1 mg/kg IV every 8 hours) for 2 weeks, then continue with doxycycline 100 mg IV or PO every 12 hours (BII) 	<p>When RIF is used, take into consideration the potential for significant interaction with ARV drugs and other medications (see Table 4 for dosing recommendations).</p> <p>If relapse occurs after initial (>3 month) course of therapy, long-term suppression with doxycycline or a macrolide is recommended as long as the CD4 count is <200 cells/mm³ (AIII).</p>
Candidiasis (Mucocutaneous)	<p>For Oropharyngeal Candidiasis—Initial Episodes (For 7–14 Days)</p> <ul style="list-style-type: none"> • Fluconazole 200 mg PO loading dose, followed by 100–200 mg PO daily (AI) <p>For Esophageal Candidiasis (For 14–21 Days)</p> <ul style="list-style-type: none"> • Fluconazole 200-mg loading dose, followed by 100–200 mg (up to 400 mg) PO or IV daily (AI). (Consider oral suspension for people with difficulty swallowing.) 	<p>For Oropharyngeal Candidiasis—Initial Episodes (For 7–14 Days)</p> <p>Oral Therapy</p> <ul style="list-style-type: none"> • Itraconazole oral solution 200 mg PO daily (BI), or • Posaconazole oral suspension 400 mg PO twice a day for 1 day, then 400 mg daily (BI), or • Posaconazole tablet 300 mg PO twice a day for 1 day, then 300 mg daily (BI) 	<p>Chronic or prolonged use of azoles may promote the development of resistance.</p> <p>Systemic azoles may have significant drug–drug interactions with ARV drugs.</p> <p>A higher relapse rate for esophageal candidiasis is seen with echinocandins use than with fluconazole.</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
	<p>For Uncomplicated Vulvovaginal Candidiasis</p> <ul style="list-style-type: none"> Fluconazole 150 mg PO for one dose (All), or Topical azoles (clotrimazole, butoconazole, miconazole, tioconazole, or terconazole) for 3–7 days (All), or Ibrexafungerp 300 mg PO twice daily for 1 day (BI) <p>For Severe or Recurrent Vulvovaginal Candidiasis</p> <ul style="list-style-type: none"> Fluconazole 100–200 mg PO daily for ≥7 days (All), or Topical antifungal ≥7 days (All) <p>For Recurrent Vulvovaginal Candidiasis Only (<i>The following regimens include treatment for the acute episode plus treatment to reduce recurrence.</i>)</p> <ul style="list-style-type: none"> Oteseconazole 600 mg PO at Day 1, 450 mg at Day 2, followed by once-weekly 150-mg dosing starting at Day 14 for 11 weeks (AI) (for those who are not of reproductive potential); or Fluconazole 150 mg PO at Days 1, 4, and 7, followed by oteseconazole 150 mg PO daily at Days 14–20, followed by oteseconazole 150 mg once weekly starting at Day 28 for 11 weeks (Weeks 4–14) (AI) (for those who are not of reproductive potential); or Fluconazole 150 mg PO every 72 hours for three doses, followed by ibrexafungerp 300 mg PO twice daily 1 day per month for 6 months (BI). (Use an effective form of contraception during treatment and for 4 days after the last dose.) 	<p><i>Topical Therapy</i></p> <ul style="list-style-type: none"> Miconazole mucoadhesive buccal 50-mg tablet once daily; apply to mucosal surface over the canine fossa once daily (do not swallow, chew, or crush tablet.) (BI), or Clotrimazole troches 10 mg PO five times daily (BI), or Nystatin suspension 4–6 mL four times a day (BII) <p>For Esophageal Candidiasis (For 14–21 Days)</p> <ul style="list-style-type: none"> Itraconazole oral solution 200 mg PO daily (AI), or Isavuconazole 400 mg PO loading dose, followed by 100 mg PO daily (BI), or Isavuconazole 400 mg PO once weekly (BI), or Voriconazole 200 mg PO or IV twice a day (BI), or Posaconazole oral suspension 400 mg PO twice a day for 1 day, then 400 mg daily (BI), or Posaconazole tablet 300 mg PO twice a day for 1 day, then 300 mg daily (BI), or Lipid formulation of amphotericin B 3–4 mg/kg IV daily (BI), or Caspofungin 70 mg IV loading dose, followed by 50 mg IV daily (BI), or Micafungin 150 mg IV daily (BI), or Anidulafungin 100 mg IV once, then 50 mg IV daily (BI) 	<p>Suppressive therapy is usually not recommended (CIII) unless patients have frequent or severe recurrences.</p> <p>If the Decision Is to Use Suppressive Therapy</p> <p><i>Oropharyngeal Candidiasis</i></p> <ul style="list-style-type: none"> Fluconazole 100 mg PO once daily or three times weekly (BI) <p><i>Esophageal Candidiasis</i></p> <ul style="list-style-type: none"> Fluconazole 100–200 mg PO daily (BI), or Posaconazole oral suspension 400 mg PO twice a day (BII), or Posaconazole tablet 300 mg PO daily (BII) <p><i>Vulvovaginal Candidiasis</i></p> <ul style="list-style-type: none"> Fluconazole 150 mg PO once weekly (BII), or Oteseconazole 600 mg at Day 1 and 450 mg at Day 2 for treatment of the acute episode, followed by once-weekly 150-mg doses starting at Day 14 for 11 weeks (AI) (for those who are not of reproductive potential); or

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
		<p>For Azole-Refractory <i>Candida glabrata</i> Vaginitis</p> <ul style="list-style-type: none"> Boric acid vaginal suppository 600 mg once daily for 14 days (BII) 	<ul style="list-style-type: none"> Fluconazole 150 mg at Days 1, 4, and 7 for treatment of the acute episode, followed by oteseconazole 150 mg daily at Days 14–20, followed by oteseconazole 150 mg once weekly starting at Day 28 for 11 weeks (Weeks 4–14) (AI) (for those who are not of reproductive potential); or Ibrexafungerp 300 mg twice daily 1 day per month for 6 months (BI). (Use an effective form of contraception during treatment and for 4 days after the last dose.)
Chagas Disease (American Trypanosomiasis)	<p>For Acute or Reactivated Disease</p> <ul style="list-style-type: none"> Benznidazole 5–8 mg/kg/day PO in two divided doses for 60 days (BIII) (commercially available at https://www.benznidazoletablets.com/en; most experts recommend a daily maximum of 300 mg), or Nifurtimox (Lampit) 8–10 mg/kg/day PO in three divided doses for 60 days (BIII) (commercially available through retail sources) 	None	<p>Treatment is effective in reducing parasitemia and preventing clinical symptoms or slowing disease progression; however, these drugs have limited efficacy in achieving parasitological cure.</p> <p>Treatment is not recommended for patients with advanced chagasic cardiomyopathy.</p> <p>Duration of therapy has not been studied in patients with HIV.</p> <p>Initiation or optimization of ART is recommended for all people with HIV with concomitant <i>Trypanosoma cruzi</i> (AIII).</p>

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Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
Coccidioidomycosis	<p>Mild to Moderate Pulmonary Infection</p> <ul style="list-style-type: none"> Fluconazole 400 mg PO daily (AII), or Itraconazole 200 mg PO three times a day for 3 days, then 200 mg PO twice a day (AII) Duration of therapy: clinical response to 3–6 months of therapy, CD4 count ≥ 250 cells/mm³, and viral suppression on ART (AII) <p>Severe Pulmonary or Extrapulmonary Infection (Except Meningitis)</p> <ul style="list-style-type: none"> Amphotericin B deoxycholate 0.7–1.0 mg/kg IV daily (AII), or Lipid formulation amphotericin B 3–5 mg/kg IV daily (AIII) Continue until clinical improvement, then switch to an azole (fluconazole 400 mg PO daily or itraconazole 200 mg PO twice daily) (BIII). Therapy should be continued for at least 12 months, and usually much longer, and should be continued in patients with HIV viremia or with CD4 count < 250 cells/mm³ (BIII). <p>Meningeal Infections</p> <ul style="list-style-type: none"> Fluconazole 800–1,200 mg PO daily (AII) Duration of therapy: lifelong (AII) 	<p>Mild to Moderate Pulmonary Infection</p> <p><i>For Patients Who Failed to Respond to Fluconazole or Itraconazole</i></p> <ul style="list-style-type: none"> Voriconazole 400 mg PO twice daily on Day 1, then 200 mg PO twice a day (BIII) Posaconazole delayed release tablet 300 mg PO twice a day on Day 1, then 300 mg PO once daily (BIII), or Isavuconazole sulfate 372 mg PO every 8 hours for six doses, then 372 mg once daily (BIII) <p>Severe Pulmonary or Extrapulmonary Infection (Except Meningitis)</p> <ul style="list-style-type: none"> Some specialists will combine amphotericin B with a triazole (fluconazole or itraconazole, with itraconazole preferred for bone disease) as initial therapy and continue triazole once amphotericin B is stopped (CIII). <p>Meningeal Infections</p> <ul style="list-style-type: none"> Itraconazole 200 mg PO two or three times daily (BII), or Voriconazole 200–400 mg PO twice daily (BIII), or Posaconazole delayed release tablet 300 mg PO twice on Day 1, then 300 mg PO once daily (CIII), or Isavuconazole sulfate 372 mg PO every 8 hours for six doses, then 372 mg once daily (CIII) Intrathecal amphotericin B deoxycholate when triazole antifungals are ineffective (AIII) 	<p>Some patients with meningitis may develop hydrocephalus and require CSF shunting.</p> <p>Therapy should be lifelong in patients with meningeal infections because relapse occurs in 80% of patients with HIV after discontinuation of triazole therapy (AII).</p> <p>See Table 4 for drug–drug interactions or triazole antifungal drugs and other drugs for treatment or prevention of OIs.</p> <p>Itraconazole, posaconazole, and voriconazole may have significant interactions with certain ARV agents. These interactions are complex and can be bidirectional. Refer to Drug–Drug Interactions in the Adult and Adolescent Antiretroviral Guidelines for dosage recommendations.</p> <p>Therapeutic drug monitoring and dosage adjustment may be necessary to ensure triazole antifungal and antiretroviral efficacy and reduce concentration-related toxicities.</p> <p>Intrathecal amphotericin B should be given only in consultation with a specialist and administered by an individual with experience with the technique.</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
Community-Acquired Bacterial Pneumonia (CAP)	<p>Empiric Outpatient Therapy for Non-severe CAP</p> <ul style="list-style-type: none"> • A PO beta-lactam (see below) plus a PO macrolide (azithromycin or clarithromycin) (AI), or • A PO respiratory fluoroquinolone (levofloxacin or moxifloxacin) (AI) [recommended for penicillin-allergic patients (AI)] <p>Note:</p> <ul style="list-style-type: none"> • Preferred PO beta-lactams: High-dose amoxicillin or amoxicillin/clavulanate • Alternative PO beta-lactams: Cefpodoxime or cefuroxime <p>Empiric Therapy for Hospitalized Patients With Non-severe CAP</p> <ul style="list-style-type: none"> • An IV beta-lactam (see below) plus a PO or IV macrolide (azithromycin or clarithromycin) (AI), or • A PO or IV respiratory fluoroquinolone (levofloxacin or moxifloxacin) (AI) [recommended for penicillin-allergic patients (AI)] <p>Note:</p> <ul style="list-style-type: none"> • Preferred IV Beta-Lactams: Ceftriaxone, cefotaxime, or ampicillin-sulbactam • Corticosteroids are not recommended for people with HIV who have non-severe CAP (BII). <p>Empiric Therapy for Patients With Severe CAP</p> <ul style="list-style-type: none"> • Prompt therapy with combination antibiotic therapy active against the range of potential pathogens is needed (AI). • An IV beta-lactam (see below) plus IV macrolide (azithromycin or clarithromycin) (AI), or 	<p>Empiric Outpatient Therapy for Non-severe CAP</p> <ul style="list-style-type: none"> • A PO beta-lactam (see below) plus PO doxycycline (BIII) <p>Note:</p> <ul style="list-style-type: none"> • Preferred PO beta-lactams: High-dose amoxicillin or amoxicillin/clavulanate • Alternative PO beta-lactams: Cefpodoxime or cefuroxime <p>Empiric Therapy for Hospitalized Patients With Non-severe CAP</p> <p><i>For Patients in Whom Macrolides or Fluroquinolones Are Contraindicated</i></p> <ul style="list-style-type: none"> • An IV beta-lactam (see below) plus PO or IV doxycycline (BIII) <p>Note:</p> <ul style="list-style-type: none"> • Preferred IV beta-lactams: Ceftriaxone, cefotaxime, or ampicillin-sulbactam • Corticosteroids are not recommended for people with HIV who have non-severe CAP (BII). <p>Empiric Therapy for Patients With Severe CAP</p> <p><i>For Penicillin-Allergic Patients</i></p> <ul style="list-style-type: none"> • Aztreonam IV plus an IV respiratory fluoroquinolone (levofloxacin or moxifloxacin) (BIII) <p><i>Adjunctive Therapy</i></p> <ul style="list-style-type: none"> • Systemic corticosteroids should be considered for patients with severe CAP, especially those who have well-controlled HIV and have increased C-reactive protein (BII). 	<p>Consider not initiating antibiotics in people who are stable enough to be treated as outpatients and have well-controlled HIV and no other significant comorbidities (BIII).</p> <p>Consider initiating empiric antibiotics to cover bacterial pathogens in CAP in people who are able to be treated as outpatients if they have significant immunocompromise (CD4 count <200 cells/mm³, noncontrolled viremia) or other comorbidities that place them at risk for progression of disease (BIII).</p> <p>Initiate empiric antibiotics to cover bacterial pathogens in non-severe CAP (AIII) or severe CAP (AIII) in people who are hospitalized.</p> <p>Empiric antimicrobial therapy should be initiated promptly for patients with clinical and radiographic evidence consistent with bacterial pneumonia. The recommendations listed are suggested empiric therapy. The regimen should be modified as needed once microbiologic and antimicrobial susceptibility testing results are available. Providers should also consider the risk of opportunistic lung infections (e.g., PCP, TB), which could affect the selection of empiric therapy.</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
	<ul style="list-style-type: none"> An IV beta-lactam (see below) plus an IV respiratory fluoroquinolone (levofloxacin or moxifloxacin) (AI) <p><i>Adjunctive Therapy</i></p> <ul style="list-style-type: none"> Systemic corticosteroids should be considered for patients with severe CAP, especially those who have well-controlled HIV and have increased C-reactive protein (BII). <p>Note:</p> <ul style="list-style-type: none"> Preferred IV Beta-Lactams: Ceftriaxone, cefotaxime, or ampicillin-sulbactam <p>Empiric Therapy for Patients With Severe CAP at Risk of <i>Pseudomonas</i> Pneumonia</p> <ul style="list-style-type: none"> An IV antipseudomonal beta-lactam (see below) plus an IV antipseudomonal fluoroquinolone (ciprofloxacin or levofloxacin) (AI) <p>Note:</p> <ul style="list-style-type: none"> Preferred IV Beta-Lactams: Piperacillin-tazobactam, cefepime, imipenem, or meropenem <p>Empiric Therapy for Patients With Severe CAP at Risk for Methicillin-Resistant <i>Staphylococcus aureus</i> Pneumonia</p> <ul style="list-style-type: none"> Add vancomycin IV or linezolid (IV or PO) to the antibiotic regimen (AII). Although not routinely recommended, for patients with severe necrotizing pneumonia, clindamycin plus vancomycin or the use of linezolid alone can be used to minimize bacterial toxin production (CII). 	<p>Empiric Therapy for Patients With Severe CAP at Risk of <i>Pseudomonas</i> Pneumonia</p> <ul style="list-style-type: none"> An IV antipseudomonal beta-lactam (see below) plus IV azithromycin (BII), or An IV antipseudomonal beta-lactam (see below) plus an IV antipseudomonal fluoroquinolone (levofloxacin or moxifloxacin) (BII) <p>Note:</p> <ul style="list-style-type: none"> Preferred IV Beta-Lactams: Piperacillin-tazobactam, cefepime, imipenem, or meropenem <p><i>For Penicillin-Allergic Patients</i></p> <ul style="list-style-type: none"> Replace the beta-lactam with IV aztreonam plus an IV antipseudomonal quinolone (levofloxacin) (BII). 	<p>Empiric monotherapy with a macrolide is not routinely recommended because of increasing pneumococcal resistance (up to 30% for erythromycin) (BIII). Patients receiving a macrolide for MAC prophylaxis may have macrolide-resistant <i>S. pneumoniae</i> due to chronic exposure (BIII).</p> <p>Fluoroquinolones should be used with caution in patients in whom TB is suspected but who are not being treated with concurrent standard four-drug TB therapy (BIII).</p> <p>Consider drug interaction potential when selecting macrolide therapy. Azithromycin, in general, has less risk for drug–drug interactions compared to clarithromycin.</p> <p>High dose levofloxacin (750 mg) is recommended for treating serious pneumonia.</p> <p>Clinical stability is defined as resolution of vital signs abnormalities (temperature, heart rate, respiratory rate, arterial oxygen saturation or partial pressure, and systolic blood pressure), and normal mentation.</p> <p>A nasal swab for MRSA can help inform whether a need exists for initial empiric coverage for MRSA (see CAP chapter for details).</p> <p>Duration</p> <ul style="list-style-type: none"> At least 5 days for most patients following

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Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
			<p>assessment of clinical stability (AII).</p> <ul style="list-style-type: none"> At least 7 days for patients with MRSA or <i>Pseudomonas</i> pneumonia (AII). Longer duration may be needed in those who are likely to take longer to achieve clinical stability, such as those with advanced HIV and CD4 count <100 cells/mm³. Longer duration of antibiotics (e.g., 7–14 days) may be necessary for patients who have severe CAP. <p>For patients begun on IV antibiotic therapy, switching to PO should be considered if improved clinically, can swallow and tolerate oral medications, and have intact gastrointestinal function (BIII).</p>
Cryptococcosis	<p>For CNS and/or Disseminated Disease</p> <p><i>Induction Therapy (For ≥2 Weeks, Followed by Consolidation Therapy)</i></p> <ul style="list-style-type: none"> In the United States and other settings where daily electrolytes and kidney function monitoring and electrolyte and IV fluid administration is possible— <ul style="list-style-type: none"> Liposomal amphotericin B 3–4 mg/kg IV daily plus flucytosine 25 mg/kg PO four times a day for 2 weeks (AII) (Note: Flucytosine dose should be adjusted in patients with renal dysfunction.) In resource-limited settings, as recommended by WHO— <ul style="list-style-type: none"> Liposomal amphotericin B 10 mg/kg IV as a single dose 	<p>For CNS and/or Disseminated Disease</p> <p><i>Induction Therapy (For ≥2 Weeks, Followed by Consolidation Therapy)</i></p> <ul style="list-style-type: none"> Amphotericin B lipid complex 5 mg/kg IV daily plus flucytosine 25 mg/kg PO four times a day for 2 weeks (BII), or Amphotericin B deoxycholate 1 mg/kg IV daily plus flucytosine 25 mg/kg PO four times a day for 1 week, followed by fluconazole 1,200 mg PO daily for an additional week (BI) 	<p>Addition of flucytosine to amphotericin B has been associated with more rapid sterilization of CSF and decreased risk for subsequent relapse.</p> <p>Patients receiving flucytosine should have either blood levels monitored (peak level 2 hours after dose should be 25–100 mcg/mL) or at least twice weekly monitoring of complete blood counts for cytopenia. Dosage should be adjusted in patients with renal insufficiency (BII).</p>

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Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
	<p>on Day 1, followed by flucytosine 25 mg/kg four times a day plus fluconazole 1,200 mg daily for 2 weeks (AI)</p> <ul style="list-style-type: none"> If not improved clinically or remain clinically unstable, continue induction therapy until the CSF culture is confirmed to be negative (BII). <p><i>Consolidation Therapy (for ≥8 Weeks, Followed by Maintenance Therapy)</i></p> <ul style="list-style-type: none"> Fluconazole 800 mg PO daily (AI) For clinically stable patients with negative CSF cultures and ART has been started, dose can be reduced to 400 mg PO daily (AII) If CSF remains positive (but clinically stable) after 2 weeks of induction therapy, use one of the following two options for an additional 2 weeks before reducing the dose of fluconazole to 800 mg PO daily: <ul style="list-style-type: none"> Fluconazole 1,200 mg PO daily with flucytosine 25 mg/kg PO four times a day for 2 weeks (BIII) Fluconazole 1,200 mg PO daily for 2 weeks (BIII), or <p>Note: Duration of consolidation therapy should be at least 8 weeks from the time of negative CSF culture (AII).</p> <p><i>Maintenance Therapy</i></p> <ul style="list-style-type: none"> Fluconazole 200 mg PO daily for ≥1 year from initiation of antifungal therapy (AI) 	<p><i>Additional Studied Induction Regimens (For 2 Weeks)</i></p> <ul style="list-style-type: none"> Amphotericin B deoxycholate 0.7–1.0 mg/kg IV daily plus flucytosine 25 mg/kg PO four times a day (BI) Liposomal amphotericin B 3–4 mg/kg IV daily plus fluconazole 800–1,200 mg PO daily (BIII) Amphotericin B deoxycholate 0.7–1.0 mg/kg IV daily plus fluconazole 800–1,200 mg PO or IV daily (BI) Fluconazole 1,200 mg PO or IV daily plus flucytosine 25 mg/kg PO four times a day (BII) <p><i>Consolidation Therapy (for ≥8 Weeks, Followed by Maintenance Therapy)</i></p> <ul style="list-style-type: none"> If fluconazole is not available or not well tolerated: Itraconazole 200 mg PO twice a day for 8 weeks (CI) <p><i>Maintenance Therapy</i></p> <ul style="list-style-type: none"> If fluconazole is not available or not well tolerated: Itraconazole 200 mg PO twice a day (CI) If susceptibility studies have been performed and the fluconazole MIC is ≥16 mcg/mL, the fluconazole dose may be increased to 400 mg daily (BIII). 	<p>Irrespective of which regimen is used, patients must be followed carefully in hospital for at least 7 days and ideally 14 days (AII). For patients with CNS disease, LP should be performed at Day 7 and Day 14 to ensure an appropriate clinical response and culture sterility. If increased ICP is documented, daily LP should be performed until the pressure is decreased into the normal range and symptoms have abated (AII).</p> <p>Opening pressure should always be measured when an LP is performed. Repeated LPs or CSF shunting are essential to effectively managing increased intracranial pressure.</p> <p>Corticosteroids and mannitol are ineffective in reducing ICP and are not recommended (AIII).</p> <p>Some specialists recommend a brief course of tapering dose of corticosteroid for management of severe IRIS symptoms (BIII).</p> <p>All people with non-CNS extrapulmonary symptoms and cryptococcal antigenemia should have their CSF sampled to rule out CNS disease.</p>

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Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
	<p>For Non-CNS Extrapulmonary (BIII) or Diffuse Pulmonary Disease (BIII) or People With Non-CNS Symptoms With Normal CSF and Serum CrAg $\geq 1:640$ by LFA (or $\geq 1:160$ by EIA or Latex Agglutination) (BII)</p> <ul style="list-style-type: none"> Treatment is the same as for CNS cryptococcosis. <p>For Non-CNS Focal Pulmonary Infiltrates (With Mild Symptoms)</p> <ul style="list-style-type: none"> Fluconazole 400 mg daily for 6 to 12 months (duration guided by symptom resolution) (BIII) <p>For Asymptomatic Antigenemia Without Meningitis and Serum CrAg $< 1:640$ by LFA (or $< 1:160$ by EIA or Latex Agglutination)</p> <ul style="list-style-type: none"> Fluconazole: 800–1,200 mg PO daily for 2 weeks, followed by 400–800 mg PO daily for a total of 10 weeks, then fluconazole 200 mg PO daily for a total of 6 months plus effective ART (BIII) 	<p>For Non-CNS Extrapulmonary (BIII) or Diffuse Pulmonary Disease (BIII) or People With Non-CNS Symptoms With Normal CSF and Serum CrAg $\geq 1:640$ by LFA (or $\geq 1:160$ by EIA or Latex Agglutination) (BII)</p> <ul style="list-style-type: none"> Alternative treatment options are the same as for CNS cryptococcosis. 	<p>People with asymptomatic cryptococcal antigenemia, lower risk, and serum CrAg titer $< 1:80$ by LFA (or $< 1:20$ by EIA or latex agglutination) can be safely treated without lumbar puncture (AI). All others with asymptomatic cryptococcal antigenemia should undergo CSF sampling to rule out CNS disease.</p>
Cryptosporidiosis	<ul style="list-style-type: none"> Aggressive oral and/or IV rehydration and replacement of electrolyte loss (AIII), <i>and</i> Symptomatic treatment of diarrhea with antimotility agents (AIII), <i>and</i> ART initiation to achieve immune restoration to CD4 count > 100 cells/mm³ (AII). 	<p>No therapy has been shown to be effective without ART. Consider a trial of these agents in conjunction with ART, rehydration, and symptomatic treatment:</p> <ul style="list-style-type: none"> Nitazoxanide 500–1,000 mg PO twice a day with food for at least 14 days (CIII), <i>or</i> Paromomycin 500 mg PO four times daily for 14–21 days (CIII) 	<p>Tincture of opium may be more effective than loperamide in management of diarrhea (CIII).</p> <p>Because diarrhea can cause lactase deficiency, patients should avoid milk products (CIII).</p>

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Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
Cystoisosporiasis	<p>For Acute Infection</p> <ul style="list-style-type: none"> • TMP-SMX (160 mg/800 mg) PO (or IV) four times daily for 10 days (AII), or • TMP-SMX (160 mg/800 mg) PO (or IV) twice daily for 7 days (BI) • In patients with persistent or worsening symptoms while on twice-daily dosing, consider increasing the daily dose and/or the duration to 3–4 weeks (BIII). • IV TMP-SMX may be used for patients with potential or documented malabsorption. <p>Chronic Maintenance Therapy (Secondary Prophylaxis)</p> <p><i>In People With CD4 Count <200 Cells/mm³</i></p> <ul style="list-style-type: none"> • TMP-SMX (160 mg/800 mg) PO three times weekly (AI), or • TMP-SMX (160 mg/800 mg) PO daily (AIII) 	<p>For Acute Infection</p> <ul style="list-style-type: none"> • Pyrimethamine^b 50–75 mg PO daily plus leucovorin 10–25 mg PO daily for 4 weeks (BIII), or • Ciprofloxacin 500 mg PO or 400 mg IV twice daily for 7 days (CI) <p>Chronic Maintenance Therapy (Secondary Prophylaxis)</p> <p><i>In People With CD4 Count <200 Cells/mm³</i></p> <ul style="list-style-type: none"> • TMP-SMX (320 mg/1,600 mg) three times weekly (BIII), or • Pyrimethamine^b 25 mg PO daily plus leucovorin 5–10 mg PO daily (BIII), or • Ciprofloxacin 500 mg three times weekly (CI) as a second-line alternative 	<p>Fluid and electrolyte management in patients with dehydration (AIII)</p> <p>Nutritional supplementation for patients who are malnourished (AIII)</p> <p>Immune reconstitution with ART may result in fewer relapses; therefore, ART initiation should not be deferred (AIII).</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
Cytomegalovirus (CMV) Disease	<p>CMV Retinitis Induction Therapy (Followed by Maintenance Therapy)</p> <ul style="list-style-type: none"> Valganciclovir 900 mg PO every 12 hours for minimum 14–21 days, then maintenance therapy with valganciclovir 900 mg PO once daily (AI), <i>or</i> Ganciclovir 5 mg/kg IV every 12 hours for minimum 14–21 days, then maintenance therapy with valganciclovir 900 mg PO once daily (AI), <i>or</i> Ganciclovir 5 mg/kg IV every 12 hours for minimum 14–21 days, then maintenance therapy with ganciclovir 5 mg/kg IV daily (AI) <p>Note: Many clinicians prefer the IV formulation when retinitis is more central and sight-threatening or when adequate GI absorption is a concern; transition to oral valganciclovir can be considered when there is evidence of clinical response.</p> <p>CMV Retinitis—Immediate Sight-Threatening Lesions (Within 1,500 Microns of the Fovea or Optic Disc)</p> <ul style="list-style-type: none"> In addition to systemic therapy (as listed above): intravitreal injections of ganciclovir (2 mg/injection) <i>or</i> foscarnet (2.4 mg/injection), repeated weekly during the induction period until lesion inactivity is achieved (BIII), followed by systemic treatment alone for maintenance therapy. <p>CMV Retinitis—Peripheral Lesions</p> <ul style="list-style-type: none"> Valganciclovir 900 mg PO every 12 hours for minimum 14–21 days, then maintenance therapy with valganciclovir 900 mg PO once daily (AI) 	<p>CMV Retinitis Induction Therapy (Followed by Maintenance Therapy)</p> <ul style="list-style-type: none"> Foscarnet 60 mg/kg IV every 8 hours or 90 mg/kg IV every 12 hours for 14–21 days, then maintenance therapy with foscarnet 90 mg/kg or 120 mg/kg IV every 24 hours (BI), <i>or</i> Cidofovir 5 mg/kg IV every week for 2 weeks, then maintenance therapy with cidofovir 5 mg/kg IV every other week. Administer 1 L of normal saline before and, if additional fluid load can be tolerated, administer another 1 L of normal saline after each cidofovir infusion. Administer probenecid 2 g PO 3 hours before each cidofovir dose followed by 1 g PO 2 hours after the dose, and 1 g PO 8 hours after the dose (total of 4 g) (CI). <p>CMV Retinitis—Immediate Sight-Threatening Lesions (Within 1,500 Microns of the Fovea or Optic Disc)</p> <ul style="list-style-type: none"> In addition to systemic therapy (as listed above): intravitreal therapy as listed in the Preferred section <p>CMV Esophagitis or Colitis</p> <ul style="list-style-type: none"> Foscarnet 60 mg/kg IV every 8 hours or 90 mg/kg IV every 12 hours (BIII)—for patients with treatment-limiting toxicities to ganciclovir or with ganciclovir resistance; <i>or</i> Cidofovir (dosing as listed above) (CI) Duration: 21–42 days or until signs and symptoms have resolved (AIII) 	<p>CMV retinitis treatment should be individualized based on tolerance of systemic medications, prior exposure to anti-CMV drugs, and location of lesions as well as with the active participation of an ophthalmologist who is familiar with diagnosis and management of this retinal disease.</p> <p>Systemic therapy must be administered to prevent disease in the contralateral eye until immune reconstitution has occurred.</p> <p>After resolution of the acute non-ocular CMV disease and initiation of effective ART, chronic maintenance therapy is not routinely recommended for CMV GI disease, pneumonia, and central nervous system disease unless there is concurrent retinitis, there have already been recurrent infections, or severe disease was present initially</p> <p>Ophthalmologic monitoring is recommended during treatment and after discontinuation of maintenance therapy and is continued after immune reconstitution. See CMV chapter for ophthalmic monitoring recommendations and frequency of follow-up.</p> <p>Initiate ART within 1–2 weeks after starting anti-CMV therapy for retinitis, esophagitis, colitis, or other end-organ diseases caused by CMV (BIII).</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
	<p>Duration of Maintenance Therapy</p> <ul style="list-style-type: none"> Continue maintenance therapy for at least 3 months, and lesions are inactive, and CD4 count ≥ 100 cells/mm³ for at least 3 months in response to ART (AII) <p>CMV Esophagitis or Colitis</p> <ul style="list-style-type: none"> Ganciclovir 5 mg/kg IV every 12 hours (AI); may switch to valganciclovir 900 mg PO every 12 hours when the patient can absorb and tolerate oral therapy (AIII). Valganciclovir 900 mg PO every 12 hours can be used in patients with mild disease (AIII). Duration: 21–42 days or until signs and symptoms have resolved (AIII) <p>CMV Pneumonia</p> <ul style="list-style-type: none"> Ganciclovir 5 mg/kg IV every 12 hours (BIII) Duration: ≥ 21 days or until signs and symptoms have resolved (CII) <p>CMV Neurological Disease</p> <ul style="list-style-type: none"> Ganciclovir 5 mg/kg IV every 12 hours plus foscarnet (60 mg/kg IV every 8 hours or 90 mg/kg IV every 12 hours) (BIII). Duration: ≥ 21 days based on clinical response (AIII) 	<p>CMV Pneumonia</p> <ul style="list-style-type: none"> Foscarnet 60 mg/kg IV every 8 hours or 90 mg/kg IV every 12 hours (BIII) Duration: ≥ 21 days or until signs and symptoms have resolved (CII) 	<p>With neurologic disease, including CMV encephalitis, ventriculitis, and radiculitis, the Panel recommends initiating ART within 2 weeks, although clinical judgment based on individual cases is needed (BIII).</p> <p>Immune recovery uveitis (IRU) may develop in the setting of immune reconstitution. See CMV chapter for information on the treatment of IRU.</p> <p>Cidofovir should be avoided in patients with sulfonamide allergy because of cross-hypersensitivity with probenecid.</p> <ul style="list-style-type: none"> For people with renal insufficiency, see Table 6 for information on dosing adjustments for valganciclovir, ganciclovir, foscarnet, and cidofovir.

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
Hepatitis B Virus (HBV) Disease	<p>ART is recommended for all people with HIV/HBV coinfection regardless of CD4 count and HBV DNA level (AII).</p> <p>The ART regimen must include drugs that are active against both HBV and HIV (AII).</p> <p>If CrCl ≥ 60 mL/min</p> <ul style="list-style-type: none"> • ART with (TAF [10 or 25 mg]^a plus FTC 200 mg) or (TAF 25 mg plus 3TC 300 mg) PO once daily (AII), <i>or</i> • ART with (TDF 300 mg plus [FTC 200 mg or 3TC 300 mg]) once daily (AII) <p>If CrCl 30–59 mL/min</p> <ul style="list-style-type: none"> • ART with TAF (10 or 25 mg)^a plus FTC 200 mg PO once daily (AII) • ART with TAF 25 mg plus 3TC 300 mg PO once daily (AII) <p>If CrCl <30 mL/min, Not on HD</p> <ul style="list-style-type: none"> • Renally dose-adjusted entecavir (in place of TDF/[FTC or 3TC] or TAF/FTC or 3TC) with a fully suppressive ART regimen (AIII), <i>or</i> • ART with renally dose-adjusted TDF and renally dose adjusted FTC or 3TC can be used (AIII) if recovery of renal function is unlikely. • If CrCl ≥ 15 to 29 mL/min, then ART with TAF (10 or 25 mg)^a once daily plus renally dose-adjusted FTC or 3TC is an option (AIII). <ul style="list-style-type: none"> ◦ Some clinicians may continue full-dose FTC to allow people to remain on fixed-dose TAF/FTC products. 	<p>For People on Tenofovir-Sparing ART</p> <ul style="list-style-type: none"> • Entecavir may be used in place of (TAF or TDF) plus (3TC or FTC) (AIII). However, entecavir should not be used in individuals with 3TC-resistant HBV, as prior 3TC resistance reduces susceptibility to entecavir (AI). Consultation with an expert is recommended. 	<p>Directly acting HBV drugs—such as FTC, entecavir, 3TC, and tenofovir—must not be given in the absence of a fully suppressive ART regimen to avoid selection of drug-resistant HIV (AI).</p> <p>Chronic administration of 3TC or FTC as the only HBV-active drug should be avoided because of the high rate of selection of HBV drug-resistance mutations (AI).</p> <p>People with 3TC-resistant HBV will have cross-resistance to FTC and partial resistance to entecavir, these agents should not be used (AI). If 3TC resistance is suspected or documented, TDF or TAF should be added to the ART regimen (AIII).</p> <p>When changing ART regimens, continue agents with anti-HBV activity (AIII).</p> <p>See Table 6 for dosing recommendation for TDF, TAF, FTC, and 3TC for people with renal impairment.</p> <p>If anti-HBV therapy is discontinued and a flare occurs, therapy should be reinstituted because it can be potentially lifesaving (AIII).</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
	<p>If on HD</p> <ul style="list-style-type: none"> ART with renally dose-adjusted TDF plus [FTC 200 mg or renally dose-adjusted 3TC once daily] (AII) ART TAF [10 or 25 mg]^a plus FTC 200 mg PO once daily (given after HD on dialysis days) (AII) <p>Duration</p> <ul style="list-style-type: none"> Continue treatment indefinitely if HBsAg remains positive (AIII). 		<p>Because HBV reactivation can occur during treatment for HCV with direct-acting antivirals in the absence of anti-HBV therapy, all people with HIV/HBV coinfection who will be treated for HCV infection should be on HBV-active ART at the time of HCV treatment initiation (AIII).</p> <p>If immunosuppressive therapy is given, HBV reactivation can occur. For people who are HBsAg-positive, treatment for HBV infection should be administered regardless of HBV DNA level (AII). For detailed recommendations, including for those who are HBsAg negative, see Hepatitis B Virus Infection.</p>
Hepatitis C Virus (HCV) Disease	<p>For Treatment-Naïve Patients Without Cirrhosis (Any Genotype or No Pre-treatment Genotype)</p> <ul style="list-style-type: none"> Glecaprevir/pibrentasvir FDC (100 mg/40 mg per tablet), three tablets daily for 8 weeks (AI), or Sofosbuvir/velpatasvir FDC (400 mg/100 mg per tablet), one tablet daily for 12 weeks (AI) <p>Characteristics that exclude patients from receiving simplified approach to therapy are outlined in Box 1 of the Hepatitis C Virus section.</p> <p>For Treatment-Naïve Patients With Compensated Cirrhosis (Recommendations Based on Genotypes)</p> <p>Genotypes 1, 2, 4–6</p> <ul style="list-style-type: none"> Glecaprevir/pibrentasvir FDC (100 mg/40 mg per tablet), three tablets daily for 8 weeks (AIII), or 	<p>For Treatment-Naïve Patients With Compensated Cirrhosis (Recommendations Based on Genotypes)</p> <p>Genotypes 1, 2, 4–6</p> <ul style="list-style-type: none"> Glecaprevir/pibrentasvir FDC (100 mg/40 mg per tablet), three tablets daily for 12 weeks (CI) <p>Genotype 3</p> <ul style="list-style-type: none"> Glecaprevir/pibrentasvir FDC (100 mg/40 mg per tablet), three tablets daily for 12 weeks (CI), or Sofosbuvir/velpatasvir FDC (400 mg/100 mg per tablet), one tablet daily with or without ribavirin for 12 weeks, pending results of nonstructural protein 5A RAS testing (CI) 	<p>A simplified approach to HCV treatment can be used in treatment-naïve patients with any genotype and without cirrhosis. This approach includes standardized treatment with no on-treatment testing or in-person follow-up and limited follow-up to confirm SVR.</p> <p>See the Hepatitis C Virus section to review a summary of drug–drug interactions between HCV therapy and ARV drugs.</p> <p>HCV treatment should not be withheld solely due to perceived lack of adherence to ART or untreated HIV (BIII).</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
	<ul style="list-style-type: none"> Sofosbuvir/velpatasvir FDC (400 mg/100 mg per tablet), one tablet daily for 12 weeks (AI) <p><i>Genotype 3</i></p> <ul style="list-style-type: none"> Glecaprevir/pibrentasvir FDC (100 mg/40 mg per tablet), three tablets daily for 8 weeks (AIII) <p>For Treatment of Acute HCV Infection</p> <ul style="list-style-type: none"> Glecaprevir/pibrentasvir FDC (100 mg/40 mg per tablet), three tablets daily for 8 weeks (AI), <i>or</i> Sofosbuvir/velpatasvir FDC (400 mg/100 mg per tablet), one tablet daily for 12 weeks (AI) 		<p>Effort should be made to document SVR (HCV RNA less than lower limits of quantification) at least 12 weeks after completion of therapy (AI). Patients without cirrhosis who achieve SVR do not require continued liver disease monitoring.</p> <p>Recommendations for treatment after DAA failure are not provided. The reader is referred to the corresponding section in the AASLD/IDSA HCV treatment guidance.</p>
Herpes Simplex Virus (HSV) Disease	<p>Orolabial Lesions (For 5–10 Days)</p> <ul style="list-style-type: none"> Valacyclovir 1 g PO twice a day (AIII), <i>or</i> Famciclovir 500 mg PO twice daily (AIII), <i>or</i> Acyclovir 400 mg PO three times daily (AIII) <p>Initial Genital Lesions (For 7–10 Days) or Recurrent Genital Lesions (For 5–10 Days)</p> <ul style="list-style-type: none"> Valacyclovir 1 g PO twice daily (AI), <i>or</i> Famciclovir 500 mg PO twice daily (AI), <i>or</i> Acyclovir 400 mg PO three times daily (AI) <p>Severe Mucocutaneous and Visceral or Disseminated HSV</p> <ul style="list-style-type: none"> Initial therapy: Acyclovir 10 mg/kg IV every 8 hours for 10–14 days (AIII) 	<p>For Acyclovir-Resistant HSV (Based on Clinical Response, Typically for 21–28 Days or Longer)</p> <p><i>Preferred Therapy</i></p> <ul style="list-style-type: none"> Foscarnet 40 mg/kg IV every 8–12 hours until clinical response (AI) <p><i>Alternative Therapy</i></p> <ul style="list-style-type: none"> Topical imiquimod 5% three times weekly (BIII), <i>or</i> Topical cidofovir 1% once daily (BIII), <i>or</i> Topical trifluridine 1% three times daily (BIII), <i>or</i> Topical foscarnet 1% five times daily (BIII), <i>or</i> IV cidofovir once weekly for 2 weeks, then every other week (CIII). See CMV Retinitis for information on concomitant probenecid and hydration. 	<p>HSV infection can be treated with episodic therapy when symptomatic lesions occur or with daily suppressive therapy to prevent recurrences.</p> <p>For ophthalmic HSV disease, consultation with an ophthalmologist experienced with HSV ocular disease is strongly recommended (AIII).</p> <p>Topical formulations of trifluridine, cidofovir, and foscarnet are not commercially available but can be extemporaneously compounded.</p> <p>An expanded access program of oral pritelivir is available for immunocompromised patients with acyclovir-resistant HSV infection. See the AiCuris Pritelivir website.</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
	<ul style="list-style-type: none"> For mucocutaneous lesions, change to PO therapy (dose as above) once lesions begin to regress (AIII); continue PO therapy until lesions have completely healed (AIII). Some clinicians will extend the course of treatment for visceral or disseminated disease based on clinical response and degree of immunosuppression. <p>Epithelial Keratitis</p> <ul style="list-style-type: none"> Valacyclovir 1 g PO twice daily for 5–10 days (BIII), <i>or</i> Acyclovir 400 mg PO five times daily for 5–10 days (BIII), <i>or</i> Trifluridine eye drops (BIII) (see Mpox for dosing), <i>or</i> Ganciclovir 0.15% gel: 1 drop into the affected eye five times a day (every 3 hours while awake) until re-epithelialization has occurred; then 1 drop three times a day for an additional 7 days (BIII) <p>Stromal Keratitis (For ≥1 Year)</p> <ul style="list-style-type: none"> Acyclovir 400 mg PO twice daily (AII) <i>or</i> valacyclovir 500 mg once daily (AIII), <i>plus</i> Prednisolone 1%: 1 drop into the affected eye six to eight times per day for at least 10 weeks followed by taper; exact course should be managed by ophthalmologist and based on individual patient course (AIII). <p>HSV Meningitis (For 10–14 Days) (AIII)</p> <ul style="list-style-type: none"> Initial therapy: Acyclovir 10 mg/kg IV every 8 hours After clinical improvement, change to valacyclovir 1 g PO three times a day 	<p>Chronic Suppressive Therapy</p> <ul style="list-style-type: none"> Acyclovir 400 mg PO twice daily (AI), <i>or</i> Famciclovir 500 mg PO twice daily (AI), <i>or</i> Valacyclovir 500 or 1,000 mg PO once daily (CIII). See the HSV chapter section for additional information. May continue indefinitely, regardless of CD4 count; re-evaluate at least annually, particularly if immune reconstitution has occurred (BIII). 	<p>Chronic suppressive therapy is indicated for people with severe or frequent recurrences of genital herpes (AI), for people who want to minimize frequency of recurrences (AI), and to reduce the risk of genital ulcer disease in people with CD4 counts <250 cells/mm³ who are starting ART (BI).</p> <p>Recurrences following episodes of acyclovir-resistant HSV can be caused by either acyclovir-resistant or acyclovir-sensitive strains; after resolution of the acyclovir-resistant episode, suppressive therapy with acyclovir can be considered to prevent additional recurrences (CIII).</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
	<p>HSV Encephalitis (For 14–21 Days) (CIII)</p> <ul style="list-style-type: none"> • Acyclovir 10 mg/kg IV every 8 hours • Some clinicians will elect to extend the course based on clinical response and degree of immunosuppression. <p>Chronic Suppressive Therapy</p> <ul style="list-style-type: none"> • Valacyclovir 500 mg PO twice daily (AI) • May continue indefinitely, regardless of CD4 count; re-evaluate annually, particularly if immune reconstitution has occurred (BIII). 		
Histoplasmosis	<p>Severe Disseminated Disease</p> <p><i>Induction Therapy (For ≥ 2 Weeks or Until Clinically Improved)</i></p> <ul style="list-style-type: none"> • Liposomal amphotericin B 3 mg/kg IV daily (AI) <p><i>Maintenance Therapy (For ≥ 12 Months)</i></p> <ul style="list-style-type: none"> • Itraconazole 200 mg PO three times a day for 3 days, then 200 mg PO twice a day (AI) <p>Mild to Moderate Disseminated Disease or Acute Pulmonary Histoplasmosis in Persons With CD4 < 300 Cells/mm³</p> <p><i>Both Induction and Maintenance Therapy (For ≥ 12 Months)</i></p> <ul style="list-style-type: none"> • Itraconazole 200 mg PO three times a day for 3 days, then 200 mg PO twice a day (AI) <p>Meningitis</p> <p><i>Induction Therapy (4–6 Weeks Depending on Symptom Resolution and Improvement of CSF Findings)</i></p> <ul style="list-style-type: none"> • Liposomal amphotericin B 5 mg/kg IV daily (AIII) 	<p>Severe Disseminated Disease</p> <p><i>Induction Therapy</i></p> <ul style="list-style-type: none"> • Amphotericin B lipid complex 5 mg/kg IV daily (AIII) <p><i>Maintenance Therapy (For ≥ 12 Months)</i></p> <ul style="list-style-type: none"> • Posaconazole extended-release tablet 300 mg PO twice a day for 1 day, then 300 mg PO once daily (BIII) • Voriconazole 400 mg PO twice a day for 1 day, then 200 mg PO twice a day (BIII), or • Fluconazole 800 mg PO daily (CII) <p>Mild to Moderate Disseminated Disease or Acute Pulmonary Histoplasmosis in People With CD4 Count < 300 Cells/mm³</p> <p><i>Both Induction and Maintenance Therapy (For ≥ 12 Months)</i></p> <ul style="list-style-type: none"> • Posaconazole extended-release tablet 300 mg PO twice a day for 1 day, then 300 mg PO once daily (BIII) 	<p>Itraconazole, posaconazole, and voriconazole may have significant interactions with certain ARV agents. These interactions are complex and can be bidirectional. Refer to Drug–Drug Interactions in the Adult and Adolescent Antiretroviral Guidelines for dosage recommendations.</p> <p>Therapeutic drug monitoring and dosage adjustment may be necessary to ensure triazole antifungal and ARV efficacy and reduce concentration-related toxicities.</p> <p>Random serum concentration of itraconazole between 1–2 mcg/mL is recommended. Frequency and severity of toxicities increase when concentration is ≥ 5 mcg/mL.</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
	<p><i>Maintenance Therapy (For ≥ 12 Months and Until Resolution of Abnormal CSF Findings)</i></p> <ul style="list-style-type: none"> Itraconazole 200 mg PO two to three times a day (AIII), with dose adjustment based on serum itraconazole concentration <p>Long-Term Suppression Therapy</p> <p><i>For Patients With Severe Disseminated or CNS Infection After Completion of ≥ 12 Months of Therapy (AIII) or Who Relapse Despite Appropriate Therapy (after reinduction therapy) (BIII)</i></p> <ul style="list-style-type: none"> Itraconazole 200 mg PO daily (AIII) 	<ul style="list-style-type: none"> Voriconazole 400 mg PO twice a day for 1 day, then 200 mg PO twice a day (BIII), or Fluconazole 800 mg PO daily (CII) <p>Meningitis</p> <p><i>Induction Therapy (4–6 Weeks Depending on Symptom Resolution and Improvement of CSF Findings)</i></p> <ul style="list-style-type: none"> Amphotericin B deoxycholate 0.7–1.0 mg/kg IV daily (BIII) <p><i>Maintenance Therapy (For ≥ 12 Months and Until Resolution of Abnormal CSF Findings)</i></p> <ul style="list-style-type: none"> Voriconazole 400 mg PO twice a day for 1 day, then 200 mg twice a day (BIII), or For people who cannot tolerate itraconazole and voriconazole: Fluconazole 800 mg PO daily (CII) <p>Long-Term Suppression Therapy</p> <ul style="list-style-type: none"> Fluconazole 400 mg PO once daily (CII) Voriconazole 200 mg PO twice daily (BIII) Posaconazole 300 mg extended-release tablet PO once daily (BIII) 	<p>The recommendations for posaconazole, voriconazole, and fluconazole are based on very limited clinical data and for people who are only moderately ill.</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
<p>Human Herpesvirus-8 (HHV-8) Associated Diseases (Kaposi Sarcoma [KS], Primary Effusion Lymphoma [PEL], Multicentric Castleman's Disease [MCD])</p>	<p>KS</p> <p><i>ACTG Stage T0 (Localized Involvement of Skin and/or Lymph Nodes and/or Minimal Oral Disease Only)</i></p> <ul style="list-style-type: none"> • ART (AII) alone, or • ART plus liposomal doxorubicin (AIII), if disease does not respond to ART alone <p><i>ACTG Stage T1 (Extensive and/or Symptomatic KS Skin Lesions, Extensive Oral Disease, Tumor-Associated Edema and/or Ulceration, or Any Visceral Involvement)</i></p> <ul style="list-style-type: none"> • ART plus liposomal doxorubicin (AI) <p>MCD</p> <ul style="list-style-type: none"> • MCD without KS: ART plus rituximab (BII) • MCD with KS: ART plus rituximab with liposomal doxorubicin (AII) <p>PEL or HHV-8 DLBCL (With or Without KS)</p> <ul style="list-style-type: none"> • PEL or HHV-8-associated DLBCL: ART plus combination chemotherapy, such as EPOCH (AIII) • PEL or HHV-8-associated DLBCL with MCD: ART plus dose-adjusted EPOCH plus rituximab (CII) <p>KSHV-Associated Inflammatory Cytokine Syndrome</p> <ul style="list-style-type: none"> • After excluding MCD and PEL, ART plus rituximab with combination chemotherapy for concurrent KS (CII) 	<p>KS</p> <p><i>ACTG Stage T1 (Extensive and/or Symptomatic KS Skin Lesions, Extensive Oral Disease, Tumor-Associated Edema and/or Ulceration, or Any Visceral Involvement)</i></p> <ul style="list-style-type: none"> • ART plus paclitaxel, if liposomal doxorubicin is not available (AI), or to treat recurrence after treatment with liposomal doxorubicin (AII), or • ART with oral pomalidomide plus thromboprophylaxis (e.g., low-dose aspirin 81 mg daily) (BII) <p>MCD</p> <ul style="list-style-type: none"> • ART plus IV ganciclovir (or oral valganciclovir) with or without high-dose zidovudine—not for use in cases of multi-organ failure, such as renal and/or hepatic failure (CII) 	<p>Treatment should be undertaken in consultation with both oncology and infectious disease specialists, with additional input from centers specifically caring for people with HIV and cancer (AIII).</p> <p>All HHV-8–specific treatments should be given with ART (AI).</p> <p>ART given concurrently with chemotherapy should be chosen to minimize drug–drug interactions and additive toxicities (AIII).</p> <p>Systemic corticosteroids or other immunosuppressants in patients with KS should either be avoided or used under close observation, given the potential for exacerbation of KS (AIII).</p> <p>Although corticosteroids appear to be effective as an adjunctive therapy for MCD, they should be used with caution or avoided, especially in patients with concurrent KS, given potential for exacerbation of life-threatening KS (AIII).</p> <p>One-third of patients receiving rituximab may have subsequent exacerbations or emergence of KS.</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection		Preferred Therapy	Alternative Therapy	Other Comments
Human Papillomavirus (HPV) Disease		Treatment of Genital Warts		<p>Patients with HIV may have larger or more numerous warts and may not respond as well to therapy for genital warts when compared to individuals without HIV.</p> <p>Intralesional interferon is usually not recommended because of high cost, difficult administration, and potential for systemic side effects (CIII).</p> <p>In patients with HIV, the rate of recurrence of genital warts despite treatment is high.</p> <p>There is no consensus on the treatment of oral warts. Many treatments for anogenital warts cannot be used in the oral mucosa. Surgery is the most common treatment for oral warts that interfere with function or for aesthetic reasons.</p>
		<p>Patient-Applied Treatment Options for Uncomplicated External Warts That Can Be Easily Identified by Patients</p> <ul style="list-style-type: none"> • Topical imiquimod 5% cream: Apply to genital warts at bedtime on three nonconsecutive nights per week for up to 16 weeks, until lesions are no longer visible. Each treatment should be washed with soap and water 6–10 hours after application (BII); or • Topical podophyllotoxin (e.g., podofilox 0.5% solution or 0.5% gel): Apply to genital warts twice a day for 3 days, followed by 4 days of no therapy. Can be repeated weekly for up to four cycles (BIII); or • Topical sinecatechins 15% ointment: Apply to affected areas three times a day for up to 16 weeks, until warts are completely cleared and not visible (BIII); or • Topical cidofovir 1%: Daily for 5 days per week for 8 weeks (CIII). Topical formulation is not commercially available but may be compounded. 	<p>Provider-Applied Therapy for Complex or Multicentric Lesions, or Lesions Inaccessible to Patient, or Due to Patient or Provider Preference</p> <ul style="list-style-type: none"> • Cryotherapy (liquid nitrogen or cryoprobe): Apply until each lesion is thoroughly frozen. Repeat every 1–2 weeks for up to 4 weeks, until lesions are no longer visible (BIII). Some specialists allow the lesion to thaw, then freeze a second time in each session (BIII); or • Trichloroacetic acid or bichloroacetic acid cauterization (80–90% aqueous solution): Apply to warts only and allow to dry until a white frost develops. Repeat weekly for up to 6 weeks, until lesions are no longer visible (BIII); or • Intralesional cidofovir (15 mg/mL solution) injected directly into the wart (maximum 1 mL per session). May be repeated every 4 weeks for total of 3–4 treatments (CIII). • Surgical excision (BIII) or laser surgery (CIII) for external or anal warts 	
Leishmaniasis	Visceral	<p>For <i>Leishmania infantum/chagasi</i></p> <ul style="list-style-type: none"> • Liposomal amphotericin B 3–5 mg/kg IV daily (AII), or • Liposomal amphotericin B interrupted schedule (e.g., 4 mg/kg on Days 1–5, 10, 17, 24, 31, 38) (AII) • To achieve total dose of 20–60 mg/kg (AII) 	<p>For <i>Leishmania infantum/chagasi</i> or <i>donovani</i></p> <ul style="list-style-type: none"> • Amphotericin B deoxycholate 0.5–1.0 mg/kg IV daily for total dose of 1.5–2.0 g (BII), or • Pentavalent antimony (meglumine antimoniate) 20 mg/kg IV or IM daily for 28 days (BII) 	<p>ART should be initiated or optimized as soon as possible (AIII).</p> <p>Pentavalent antimony is for investigational use only.</p> <p>For miltefosine, visit www.profounda.com.</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection		Preferred Therapy	Alternative Therapy	Other Comments
		<p>For <i>Leishmania donovani</i></p> <ul style="list-style-type: none"> Liposomal amphotericin B 5 mg/kg on Days 1, 3, 5, 7, 9, and 11 plus miltefosine 50 mg PO twice daily (for 28 days if from East Africa or 14 days if from Southeast Asia) (BI) <p>Chronic Maintenance Therapy</p> <p>For Patients With CD4 Count <200 Cells/mm³ (AII)</p> <ul style="list-style-type: none"> Liposomal amphotericin B 4 mg/kg IV every 2–4 weeks (AII) 	<p>For <i>Leishmania donovani</i></p> <ul style="list-style-type: none"> Liposomal amphotericin B 3–5 mg/kg IV daily to achieve total dose of 20–60 mg/kg (AII), or Liposomal amphotericin B interrupted schedule (e.g., 4 mg/kg on Days 1–5, 10, 17, 24, 31, 38) to achieve total dose of 20–60 mg/kg (AII), or For Indian <i>L. donovani</i>: Miltefosine ~2.5–3.0 mg/kg PO daily in two or three divided doses (maximum 150 mg daily) for 28 days (BII) <p>Chronic Maintenance Therapy (Secondary Prophylaxis)</p> <ul style="list-style-type: none"> Amphotericin B lipid complex 3 mg/kg IV every 21 days (BII), or Pentavalent antimony (meglumine antimoniate) 20 mg/kg IV or IM every 4 weeks (BII), or Pentamidine 4 mg/kg (maximum 300 mg) IV every 2–4 weeks (BII) 	
	Cutaneous	<p>For Initial Infection</p> <ul style="list-style-type: none"> Liposomal amphotericin B 4 mg/kg IV daily for 10 days (BIII) to achieve total dose of 20–60 mg/kg, or Liposomal amphotericin B interrupted schedule (e.g., 4 mg/kg on Days 1–5, 10, 17, 24, 31, 38) to achieve total dose of 20–60 mg/kg (BIII), or Miltefosine 2.5 mg/kg/day PO in two or three divided doses for 28 days (maximum 150 mg per day) (BIII), or 	<p>Possible Options</p> <ul style="list-style-type: none"> Cryotherapy, or Topical paromomycin, or Intralesional pentavalent antimony (meglumine antimoniate) or pentamidine, or PO or IV fluconazole (<i>L. major</i> and <i>L. mexicana</i>) IV pentamidine Local heat therapy 	<p>ART should be initiated or optimized as soon as possible (AIII).</p> <p>Pentavalent antimony is for investigational use only.</p> <p>For miltefosine, visit www.profounda.com.</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection		Preferred Therapy	Alternative Therapy	Other Comments
		<ul style="list-style-type: none"> Pentavalent antimony (meglumine antimoniate) 20 mg/kg IV or IM daily for 28 days (BIII) <p>Chronic Maintenance Therapy</p> <ul style="list-style-type: none"> May be indicated in immunocompromised patients with multiple relapses (CIII) Drugs and doses same as for visceral leishmaniasis 	No data exist for any of these agents in patients with HIV; choice and efficacy are dependent on species of <i>Leishmania</i> .	
Malaria		<p>Because <i>Plasmodium falciparum</i> malaria can progress within hours from mild symptoms or low-grade fever to severe disease or death, all people with HIV with confirmed or suspected <i>P. falciparum</i> infection should be hospitalized for evaluation, initiation of treatment, and observation (AIII).</p> <p>Treatment recommendations for people with HIV, regardless of CD4 count, are the same as for patients without HIV (AIII).</p> <p>Choice of therapy is guided by the degree of parasitemia, the species of <i>Plasmodium</i>, the person's clinical status, and the antimalarial susceptibility profile of the local <i>Plasmodium</i> species. Guidance can be found at CDC's Clinical Guidance: Malaria Diagnosis & Treatment in the U.S. webpage.</p>	When suspicion for malaria is low and the individual is not severely ill, antimalarial treatment can often be deferred until the diagnosis is confirmed by laboratory investigation (AIII).	For treatment recommendations for specific regions, clinicians should refer to CDC's Clinical Guidance: Malaria Diagnosis & Treatment in the U.S. webpage or call the CDC Malaria Hotline: 770-488-7788, Monday–Friday, 8 a.m.–4:30 p.m. ET, or 770-488-7100 after hours.
Microsporidiosis		<p>For GI Infections Caused by <i>Enterocytozoon bienuesi</i></p> <ul style="list-style-type: none"> Initiate or optimize ART with immune restoration to CD4 count >100 cells/mm³ (AII), <i>plus</i> Manage dehydration and diarrhea with fluid support (AII) and malnutrition and wasting with nutritional supplements (AIII). 	<p>For GI Infections Caused by <i>E. bienuesi</i></p> <ul style="list-style-type: none"> Fumagillin 60 mg/day (BII) and TNP-470 (a synthetic analog of fumagillin) (BIII) may be effective, but neither is available in the United States. Nitazoxanide (1,000 mg twice daily) may have some effect, but response may be minimal in patients with low CD4 counts (CIII). 	Antimotility agents can be used for diarrhea control if required (BIII).

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
	<p>For Intestinal and Disseminated (Not Ocular) Infections Caused by Microsporidia Other Than <i>E. bienuesi</i> and <i>Vittaforma corneae</i></p> <ul style="list-style-type: none"> Albendazole 400 mg PO twice daily (AII), continue until CD4 count >200 cells/mm³ for >6 months after initiation of ART (BIII) <p>For Disseminated Disease Caused by <i>Trachipleistophora</i> or <i>Anncaliia</i></p> <ul style="list-style-type: none"> Itraconazole 400 mg PO daily plus albendazole 400 mg PO twice daily (CIII) <p>For Ocular Infection</p> <ul style="list-style-type: none"> Topical fumagillin bicyclohexylammonium (Fumidil B) eye drops 3 mg/mL in saline (fumagillin 70 mcg/mL): Two eye drops every 2 hours for 4 days, then two eye drops four times daily (investigational use only in United States) (BII) plus albendazole 400 mg PO twice daily, for management of systemic infection (BIII) <p>If CD4 Count >200 Cells/mm³</p> <ul style="list-style-type: none"> Continue until symptoms resolve (CIII). <p>If CD4 Count ≤200 Cells/mm³</p> <ul style="list-style-type: none"> Continue until resolution of ocular symptoms and CD4 count increases to >200 cells/mm³ for >6 months in response to ART (BIII). 		

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
Mpox	<p>For People With Mild to Moderate Disease Who Are Not at Risk for Severe Disease</p> <ul style="list-style-type: none"> Supportive care, including adequate pain control (BIII), and referral to clinical trials, if available (CIII). CDC can provide additional guidance to clinicians with patient management questions (see Other Comments for contact information). <p>For Severe Disease or People at Risk for Severe Disease (See Other Comments for Definition)</p> <ul style="list-style-type: none"> Tecovirimat 600 mg PO every 12 hours (40 to <120 kg) or every 8 hours (≥120 kg) for 14 days (BIII) within 30 minutes of a fatty meal, <i>or</i> Tecovirimat 200 mg IV every 12 hours for 14 days (35 to <120 kg) or 300 mg IV every 12 hours (≥120 kg) infused over 6 hours (BIII) if concern exists regarding altered GI absorption capacity, inability to take PO, or severity of illness <p><i>Adjunctive Therapy</i></p> <ul style="list-style-type: none"> Cidofovir 5 mg/kg/week IV for two doses with saline hydration before and after therapy and probenecid 2 g PO 3 hours before the dose followed by 1 g PO 2 hours after the dose and 1 g PO 8 hours after the dose (total of 4 g) (BIII), <i>or</i> Brincidofovir 200 mg PO once weekly for two doses (BIII), <i>or</i> VIGIV 6,000–9,000 units/kg IV single dose (BIII) 	None	<p>People with severe mpox or are at high risk for severe mpox should receive directed mpox antiviral treatment (BIII) with early consultation with CDC or an expert in mpox treatment and prompt use of combination therapy, ideally at the time of the first medical encounter and after considering the risks and benefits (CIII). Contact: poxvirus@cdc.gov or 770-488-7100</p> <p>Tecovirimat, brincidofovir, and VIGIV are available via expanded access or emergency IND.</p> <p>People with severe immunocompromise might benefit from extended treatment (i.e., >14 days) if new confirmed mpox lesions occur or existing lesions or symptoms worsen despite treatment (CIII).</p> <p>Effective ART should be initiated as soon as possible (AIII).</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
	<p><i>For Ocular Mpox</i></p> <ul style="list-style-type: none"> • Tecovirimat 600 mg PO every 12 hours (40 to <120 kg) or every 8 hours (≥120 kg) for 14 days (BIII) within 30 minutes of a fatty meal, <i>plus</i> • Trifluridine (Viroptic) 1 drop into affected eye(s) every 2 hours when awake (max: 9 drops/day) until re-epithelialization, then every 4 hours (min: 5 drops/day) for 7 days, or until all periocular lesions have healed (BIII) in consultation with an ophthalmologist (BIII) <ul style="list-style-type: none"> o Prolonged use of trifluridine beyond 21 days might cause corneal epithelial toxicity and should be avoided (AII). 		<p>Definition for Severe Disease: Hemorrhagic disease; lesions affecting ≥25% of body surface that may be confluent, necrotic, and/or hemorrhagic in appearance or cause sepsis; disease resulting in airway compromise or affecting the nervous system; cardiac and/or neurologic disease; ocular or periorbital infections; other conditions requiring hospitalization. Consult the CDC's Tecovirimat webpage for more details.</p> <p>Definition for at Risk for Severe Disease: Not virologically suppressed, CD4 counts <200 cells/mm³, have another immunocompromising condition, have atopic dermatitis/other conditions affecting skin integrity, or are children, pregnant, or breastfeeding. Consult the CDC's Tecovirimat webpage for more details.</p>
<i>Mycobacterium avium</i> Complex (MAC) Disease	<p>At Least Two Drugs as Initial Therapy to Prevent or Delay Emergence of Resistance (AII)</p> <ul style="list-style-type: none"> • Clarithromycin 500 mg PO twice daily (AI) plus ethambutol 15 mg/kg PO daily (AI), <i>or</i> • Azithromycin 500–600 mg (AII) (when drug interactions, intolerance, or adherence issues preclude the use of clarithromycin [AII]) plus ethambutol 15 mg/kg PO daily (AI) 	<p>A third or fourth drug should be used if more severe disease is present, the risk of mortality is high, emergence of drug resistance is likely (e.g., after failure of MAC prophylaxis), if mycobacterial loads are high (>2 log₁₀ CFU/mL of blood), if the patient is not on ART, or if there is an absence of viral suppression on ART (CIII).</p> <ul style="list-style-type: none"> • Third Drug: <ul style="list-style-type: none"> o Rifabutin 300 mg PO daily (dose adjustment may be necessary based on drug interactions) (CI) 	<p>Testing of susceptibility to clarithromycin and azithromycin is recommended.</p> <p>NSAIDs may be used for people with HIV who experience mild or moderate symptoms attributed to IRIS (BIII).</p> <p>If IRIS symptoms are more severe or unremitting, a short-term course (4–8 weeks) of systemic corticosteroid therapy (equivalent to prednisone 20–40 mg/day) can be used (BII).</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
	<p>Duration</p> <ul style="list-style-type: none"> At least 12 months (All) Shorter duration may be considered. CD4 count should be >100 cells/mm³ for ≥ 6 months in response to ART before discontinuation of MAC therapy (CIII). 	<ul style="list-style-type: none"> Refer to the Dosing Recommendations for Use of ARV and Anti-TB Drugs for Treatment of Active Drug Sensitive TB table of the <i>Mycobacterium tuberculosis</i> section for dosing recommendations. Fourth Drug: <ul style="list-style-type: none"> A fluoroquinolone (CIII) (levofloxacin 500 mg PO daily or moxifloxacin 400 mg PO daily), or An injectable aminoglycoside (CIII) (amikacin 10–15 mg/kg IV daily) 	<p>Bedaquiline, tedizolid, linezolid, and omadacycline have demonstrated <i>in vitro</i> activity against clinical isolates of MAC; these might also be considered in people with refractory MAC disease.</p> <p>For information on drug–drug interactions between antimycobacterial agents (e.g. clarithromycin, rifabutin, bedaquiline) and concomitant antiretrovirals, refer to the Liverpool HIV Drug Interaction Checker.</p> <p>See Table 6 for renal dosing recommendations (e.g. clarithromycin, rifabutin, levofloxacin, and aminoglycosides).</p>
<i>Mycobacterium tuberculosis</i> (TB) Disease: Drug-Susceptible TB	<p>Refer to the Dosing Recommendations for Use of ARV and Anti-TB Drugs for Treatment of Active Drug Sensitive TB table in the <i>Mycobacterium tuberculosis</i> section for dosing recommendations.</p> <p>Intensive Phase (8 Weeks)</p> <ul style="list-style-type: none"> INH (plus pyridoxine) plus (RIF or RFB) plus PZA plus EMB PO daily (AI) If drug-susceptibility report shows sensitivity to INH and RIF, then EMB may be discontinued before the end of 2 months (AI). <p>Continuation Phase (Duration Depends on Site and Severity of Infection as Noted Below)</p> <ul style="list-style-type: none"> INH (plus pyridoxine) plus (RIF or RFB) PO daily (All) <p>Total Duration of Therapy for Drug-Susceptible TB</p> <ul style="list-style-type: none"> <i>Pulmonary, uncomplicated TB</i>: 6 months (BII) 	<p>Only for Patients Receiving an Efavirenz-Based ARV Regimen; Not Recommended for Extrapulmonary TB</p> <p><i>Intensive Phase (8 Weeks)</i></p> <ul style="list-style-type: none"> INH plus RPT 1,200 mg plus moxifloxacin 400 mg plus PZA plus pyridoxine 25–50mg PO daily (AI)^c <p><i>Continuation Phase (9 Weeks)</i></p> <ul style="list-style-type: none"> INH plus RPT 1200 mg plus moxifloxacin 400 mg plus pyridoxine 25–50mg PO daily (AI) 	<p>DOT is recommended for all patients (All).</p> <p>All rifamycins may have significant pharmacokinetic interactions with ARV drugs; please refer to the Dosing Recommendations for Use of ARV and Anti-TB Drugs for Treatment of Active Drug Sensitive TB table in the <i>Mycobacterium tuberculosis</i> section and the Drug–Drug Interactions section of the Adult and Adolescent Antiretroviral Guidelines for dosing recommendations.</p> <p>Therapeutic drug monitoring should be considered in patients receiving rifamycin and interacting ART.</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
	<ul style="list-style-type: none"> <i>Pulmonary TB with positive culture at 8 weeks of TB treatment, or severe cavitory or disseminated extrapulmonary TB: 9 months (BII)</i> <i>TB meningitis: 9–12 months (BII)</i> <i>Extrapulmonary TB in Other sites: 6 months (BII)</i> 		<p>Adjunctive corticosteroids for TB meningitis (AII): Dexamethasone 0.3–0.4mg/kg/day for 2–4 weeks, then taper by 0.1 mg/kg per week until 0.1 mg/kg, then 4 mg per day, and taper by 1 mg/week for total of 12 weeks.</p>
<i>Mycobacterium tuberculosis</i> (TB) Disease: Drug-Resistant TB	<p>Refer to the Dosing Recommendations for Use of ARV and Anti-TB Drugs for Treatment of Active Drug Sensitive TB table in the <i>Mycobacterium tuberculosis</i> section for dosing recommendations.</p> <p>Empiric Therapy for Suspected Resistance to Rifamycin^d +/- Resistance to Other Drugs</p> <ul style="list-style-type: none"> INH (plus pyridoxine) plus PZA plus EMB plus (moxifloxacin or levofloxacin) plus (linezolid or amikacin^e) (BII) <p>Confirmed Resistance to INH</p> <ul style="list-style-type: none"> (Moxifloxacin or levofloxacin) plus (RIF or RFB) plus EMB plus PZA for 6 months (BII) <p>Confirmed Resistance to Rifamycin +/- Other Drugs (AI)</p> <p><i>For 14 Days</i></p> <ul style="list-style-type: none"> Pretomanid 200 mg plus linezolid 600 mg plus moxifloxacin 400 mg daily plus bedaquiline 400 PO daily, <i>followed by</i> <p><i>For 24 Weeks</i></p> <ul style="list-style-type: none"> Pretomanid 200 mg plus linezolid 600 mg plus moxifloxacin 400 mg daily, <i>and</i> Bedaquiline 200 mg PO three times per week <p>Omit moxifloxacin if resistant to fluoroquinolones (AI).</p>	<p><i>Confirmed Resistance to Rifamycin +/- Other Drugs</i></p> <ul style="list-style-type: none"> Therapy should be individualized based on drug-susceptibility results and clinical and microbiologic responses, to include ≥5 active drugs, and with close consultation with experienced specialists (BIII). 	<p>At doses above 16 mg, dexamethasone is a CYP3A4 inducer and can decrease certain ARVs that are substrates of CYP3A4 (e.g., DOR, RPV, and protease inhibitors). Consultation with a pharmacist is recommended.</p> <p>Adjunctive corticosteroid is not recommended for patients with TB pericarditis (AI).</p> <p>See text for recommendations on preventing and managing paradoxical TB-IRIS, including prednisone dosing recommendations.</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
	<p>Duration</p> <ul style="list-style-type: none"> 6–24 months (see Managing Drug-Resistant TB in the <i>Mycobacterium tuberculosis</i> section for discussion) 		
<i>Pneumocystis</i> Pneumonia (PCP)	<p>People with HIV who develop PCP despite TMP-SMX prophylaxis can usually be treated with standard doses of TMP-SMX (BIII).</p> <p>Duration of PCP treatment: 21 days (AII)</p> <p>For Moderate to Severe PCP</p> <ul style="list-style-type: none"> TMP-SMX: (TMP 15–20 mg/kg/day and SMX 75–100 mg/kg/day) IV given in divided doses every 6 or 8 hours (AI); may switch to PO formulations after clinical improvement (AI). <p>For Mild to Moderate PCP</p> <ul style="list-style-type: none"> TMP-SMX: (TMP 15–20 mg/kg/day and SMX 75–100 mg/kg/day) PO given in three divided doses (AI), <i>or</i> TMP-SMX: (160 mg/800 mg or DS) two tablets PO three times daily (AI) <p>Secondary Prophylaxis, After Completion of PCP Treatment</p> <ul style="list-style-type: none"> TMP-SMX DS: one tablet PO daily (AI), <i>or</i> TMP-SMX (80 mg/400 mg or SS): one tablet PO daily (AI) 	<p>For Moderate to Severe PCP</p> <ul style="list-style-type: none"> Primaquine 30 mg (base) PO daily plus (clindamycin 600 mg IV every 6 hours or 900 mg IV every 8 hours) or (clindamycin 450 mg PO every 6 hours or 600 mg PO every 8 hours) (AI) (some clinicians prefer this option because it is more effective and less toxic than pentamidine), <i>or</i> Pentamidine 4 mg/kg IV daily infused over ≥60 minutes (AI); can reduce dose to 3 mg/kg IV daily in the event of toxicities (BI) <p>For Mild to Moderate PCP</p> <ul style="list-style-type: none"> Dapsone 100 mg PO daily plus TMP 15 mg/kg/day PO given in three divided doses (BI), <i>or</i> Primaquine 30 mg (base) PO daily plus (clindamycin 450 mg PO every 6 hours or 600 mg PO every 8 hours) (BI), <i>or</i> Atovaquone 750 mg PO twice daily with food (BI) <p>Secondary Prophylaxis, After Completion of PCP Treatment</p> <p>The following regimens can be used for people who are seropositive or seronegative for <i>Toxoplasma gondii</i>:</p> <ul style="list-style-type: none"> TMP-SMX DS: one tablet PO three times weekly (BI), <i>or</i> 	<p>Indications for Adjunctive Corticosteroids for Moderate to Severe PCP (AI)</p> <ul style="list-style-type: none"> PaO₂ <70 mmHg at room air, <i>or</i> A-a gradient ≥35 mmHg <p>Prednisone Doses (Beginning as Early as Possible and Within 72 Hours of PCP Therapy) (AI)</p> <ul style="list-style-type: none"> Days 1–5: 40 mg PO twice daily Days 6–10: 40 mg PO daily Days 11–21: 20 mg PO daily <p>IV methylprednisolone can be administered as 80% of prednisone dose.</p> <p>Benefit of using a corticosteroid if started after 72 hours of treatment is unknown, but some clinicians will use it for moderate to severe PCP (BIII).</p> <p>Whenever possible, patients should be tested for G6PD before use of dapsone or primaquine. Alternative therapy should be used in patients found to have G6PD deficiency.</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
		<ul style="list-style-type: none"> • Dapsone 50 mg PO daily with pyrimethamine^b 50 mg plus leucovorin 25 mg PO weekly (BI), or • Dapsone 200 mg plus pyrimethamine^b 75 mg plus leucovorin 25 mg PO weekly (BI), or • Atovaquone 1,500 mg PO daily with food (BI) <p>The following regimens should only be used if the person is seronegative for <i>Toxoplasma gondii</i>:</p> <ul style="list-style-type: none"> • Dapsone 100 mg PO daily (BI), or • Aerosolized pentamidine 300 mg monthly via Respirgard II nebulizer (BI), or • Intravenous pentamidine 300 mg every 28 days (CIII) 	<p>Patients who are receiving pyrimethamine^b/sulfadiazine for the treatment or suppression of toxoplasmosis do not require additional PCP prophylaxis (AII).</p> <p>If TMP-SMX is discontinued because of a mild adverse reaction, reinstitution should be considered after the reaction resolves (AII). The dose can be increased gradually (desensitization) (BI) or the drug can be given at a reduced dose or frequency (CIII).</p> <p>TMP-SMX should be permanently discontinued in patients with possible or definite Stevens-Johnson syndrome or toxic epidermal necrosis (AIII). See alternative options.</p>
Progressive Multifocal Leukoencephalopathy (PML)/JC Virus Infections	<p>There is no specific antiviral therapy for JC virus infection. The main treatment approach is to reverse the immunosuppression caused by HIV.</p> <p>Initiate ART immediately in ART-naïve patients (AII).</p> <p>Optimize ART to achieve viral suppression in patients who develop PML and receive ART but remain viremic (AIII).</p>	None	<p>Corticosteroids may be used for PML-IRIS (BIII). The optimal corticosteroid regimen has not been established but should be tailored to individual patients.</p> <p>ART should not be discontinued during PML-IRIS (AIII).</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
Syphilis (<i>Treponema pallidum</i> Infection)	<p>Primary, Secondary, and Early Latent Syphilis (≤ 1 Year)</p> <ul style="list-style-type: none"> Benzathine penicillin G 2.4 million units IM for one dose (AII) <p>Late Latent Disease (>1 Year) or Latent of Unknown Duration</p> <ul style="list-style-type: none"> Benzathine penicillin G 2.4 million units IM weekly for three doses (AII) <p>Tertiary–Cardiovascular or Gummatous Disease (Without Neurosyphilis)</p> <ul style="list-style-type: none"> Benzathine penicillin G 2.4 million units IM weekly for three doses (AII) Note: Consider CSF examination. People with CSF abnormalities should be treated with a regimen for neurosyphilis (AII). <p>Neurosyphilis, Ocular Syphilis, or Otic Syphilis</p> <ul style="list-style-type: none"> Aqueous crystalline penicillin G 18–24 million units per day (administered as 3–4 million units IV every 4 hours or by continuous IV infusion) for 10–14 days (AII) <p>For Penicillin-Allergic Patients</p> <ul style="list-style-type: none"> Desensitization to penicillin 	<p>Primary, Secondary, and Early Latent Syphilis (≤ 1 Year)</p> <ul style="list-style-type: none"> Doxycycline 100 mg PO twice daily for 14 days (BII), or Ceftriaxone 1 g IM or IV daily for 10–14 days (BII) <p>For Penicillin-Allergic Patients</p> <ul style="list-style-type: none"> If adherence or follow-up cannot be ensured, desensitize and treat with benzathine penicillin G (AIII). <p>Late Latent Disease (>1 Year) or Latent of Unknown Duration</p> <ul style="list-style-type: none"> Doxycycline 100 mg PO twice a day for 28 days (BIII) 	<p>The efficacy of non-penicillin alternatives has not been well evaluated in people with HIV, and they should be used only with close clinical and serologic monitoring. Azithromycin should not be used as treatment for syphilis (AII).</p> <p>In the setting of drug shortages, refer to the FDA's Drug Shortages and CDC's Availability of STI Testing and Treatment Products webpages for information and alternatives.</p> <p>For pregnancy considerations, please see the Syphilis chapter.</p> <p>Skin testing for penicillin allergy can be useful, if available. Among people for whom the only option is penicillin (e.g., syphilis in pregnancy) and among those with a positive skin test, desensitization to penicillin in consultation with a specialist is the preferred approach. Skin testing, challenge, and desensitization may be contraindicated in certain individuals.</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
		<p><i>For Penicillin-Allergic Patients</i></p> <ul style="list-style-type: none"> • If adherence or follow-up cannot be ensured, desensitize and treat with benzathine penicillin G (AIII). <p>Tertiary–Cardiovascular or Gummatous Disease (Without Neurosyphilis)</p> <p><i>For Penicillin-Allergic Patients</i></p> <ul style="list-style-type: none"> • Treat in consultation with infectious diseases specialist. <p>Neurosyphilis, Ocular Syphilis, or Otis Syphilis</p> <ul style="list-style-type: none"> • Procaine penicillin 2.4 million units IM daily plus probenecid 500 mg PO four times a day for 10–14 days (BII). However, procaine penicillin has been discontinued by the manufacturer as of June 2023. • Note: People who are allergic to sulfa-containing medications should not be given probenecid. <p><i>For Penicillin-Allergic Patients</i></p> <ul style="list-style-type: none"> • Ceftriaxone 2 g IM or IV daily for 10–14 days (BII) • Note: Limited data suggest ceftriaxone may be an option for neurosyphilis treatment with shared decision-making. The risk for penicillin cross-reactivity between third-generation cephalosporins is low; see Alternative Regimens for details. 	<p>The Jarisch-Herxheimer reaction is an acute febrile reaction accompanied by headache, fever, and myalgia that can occur within the first 24 hours after therapy. This reaction occurs most frequently in people with early syphilis and can induce early labor or cause fetal distress during pregnancy. Patients should be informed about this potential reaction to treatment and that it is not an allergic reaction to penicillin.</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
Talaromycosis (Penicilliosis)	<p>Induction Therapy</p> <ul style="list-style-type: none"> Liposomal amphotericin B 3–5 mg/kg/day IV (AIII) <p><i>Duration</i></p> <ul style="list-style-type: none"> 2 weeks (AIII), followed by consolidation therapy <p>Consolidation Therapy</p> <ul style="list-style-type: none"> Itraconazole 200 mg PO every 12 hours for 10 weeks (AI), followed by chronic maintenance therapy <p>Chronic Maintenance Therapy</p> <ul style="list-style-type: none"> Itraconazole 200 mg PO once daily (AI) 	<p>Induction Therapy</p> <ul style="list-style-type: none"> Amphotericin B deoxycholate 0.7 mg/kg/day IV (if liposomal amphotericin B is not available) (AI) <p><i>Duration</i></p> <ul style="list-style-type: none"> 2 weeks (AI), followed by consolidation therapy <p><i>If Amphotericin B Is Not Available, Contraindicated, or Not Tolerated</i></p> <ul style="list-style-type: none"> Voriconazole 6 mg/kg IV every 12 hours on Day 1 (loading dose), then 4 mg/kg IV every 12 hours (BII), or Voriconazole 600 mg PO every 12 hours on Day 1 (loading dose), then 400 mg PO every 12 hours (BII) <i>Duration:</i> 2 weeks (BII), followed by consolidation therapy with itraconazole (preferred) or voriconazole <p>Consolidation Therapy</p> <ul style="list-style-type: none"> Voriconazole 200 mg PO every 12 hours for 10 weeks (BII), followed by chronic maintenance therapy <p>Chronic Maintenance Therapy</p> <ul style="list-style-type: none"> Itraconazole should be used (AI). Optimal dose of voriconazole for maintenance therapy has not been studied. 	<p>Itraconazole is not recommended as induction therapy for talaromycosis (AI).</p> <p>ART should be initiated as early as 1 week after initiation of treatment for talaromycosis (AI).</p> <p>Itraconazole and voriconazole may have significant interactions with certain ARV agents. These interactions are complex and can be bidirectional. Refer to Drug–Drug Interactions in the Adult and Adolescent Antiretroviral Guidelines for dosage recommendations.</p> <p>Itraconazole and voriconazole concentrations should be monitored beginning at 5 days and dose adjusted as needed to obtain serum trough concentrations for itraconazole should be >0.5 mcg/mL (for a combined itraconazole plus hydroxyitraconazole level) and >1 mcg/mL for voriconazole (BIII).</p> <p>Itraconazole solution is generally preferred over the capsule formulation because of improved bioavailability.</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
<i>Toxoplasma gondii</i> Encephalitis	<p>Treatment of Acute Infection</p> <ul style="list-style-type: none"> Pyrimethamine^b 200 mg PO one time, followed by weight-based therapy (AI): <ul style="list-style-type: none"> If ≤60 kg: Pyrimethamine^b 50 mg PO once daily plus sulfadiazine 1,000 mg PO every 6 hours plus leucovorin 10–25 mg PO once daily If >60 kg: Pyrimethamine^b 75 mg PO once daily plus sulfadiazine 1,500 mg PO every 6 hours plus leucovorin 10–25 mg PO once daily Note: Leucovorin dose can be increased to 50 mg daily or twice a day. TMP-SMX (TMP 5 mg/kg and SMX 25 mg/kg) IV or PO twice a day (AII) <p>Duration for Acute Therapy</p> <ul style="list-style-type: none"> At least 6 weeks (BII); longer duration if clinical or radiologic disease is extensive or response is incomplete at 6 weeks After completion of acute therapy, all patients should be initiated on chronic maintenance therapy. <p>Chronic Maintenance Therapy</p> <ul style="list-style-type: none"> Pyrimethamine^b 25–50 mg PO daily plus sulfadiazine 2,000–4,000 mg PO daily (in 2–4 divided doses) plus leucovorin 10–25 mg PO daily (AI), or TMP-SMX DS one tablet twice a day (AII) 	<p>Treatment of Acute Infection</p> <ul style="list-style-type: none"> Pyrimethamine^b (leucovorin)* plus clindamycin 600 mg IV or PO every 6 hours (AI), or Atovaquone 1,500 mg PO twice a day with food plus pyrimethamine^b (leucovorin)* (BII), or Atovaquone 1,500 mg PO twice a day with food plus sulfadiazine 1,000–1,500 mg PO every 6 hours (weight-based dosing, as in preferred therapy) (BII), or Atovaquone 1,500 mg PO twice a day with food (BII) <p>Chronic Maintenance Therapy</p> <ul style="list-style-type: none"> (Pyrimethamine^b 25–50 mg plus leucovorin 10–25 mg) PO daily plus clindamycin 600 mg PO every 8 hours plus (BI), or Atovaquone 750–1,500 mg PO twice a day plus (pyrimethamine^b 25 mg plus leucovorin 10 mg) PO daily (BII), or Atovaquone 750–1,500 mg PO twice a day plus sulfadiazine 2,000–4,000 mg PO daily (in two to four divided doses) (BII), or Atovaquone 750–1,500 mg PO twice a day with food (BII) <p>* Pyrimethamine^b and leucovorin doses are the same as for preferred therapy.</p>	<p>If pyrimethamine is unavailable or there is a delay in obtaining it, TMP-SMX should be used in place of pyrimethamine-sulfadiazine (AII).</p> <p>For patients with a history of sulfa allergy, sulfa desensitization should be attempted using one of several published strategies (BI).</p> <p>Atovaquone should be administered until therapeutic doses of TMP-SMX are achieved (CIII).</p> <p>Adjunctive corticosteroids (e.g., dexamethasone) should only be administered when clinically indicated to treat mass effect associated with focal lesions or associated edema (BIII); discontinue as soon as clinically feasible.</p> <p>Antiseizure medications should be administered to patients with a history of seizures (AII) and continued through acute treatment (BII) but should not be used as seizure prophylaxis (BII).</p> <p>If clindamycin is used in place of sulfadiazine, additional therapy must be added to prevent PCP (AII).</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
Varicella Zoster Virus (VZV) Disease	<p>Primary Varicella Infection (Chickenpox)</p> <p><i>Uncomplicated Cases</i></p> <ul style="list-style-type: none"> Initiate as soon as possible after lesion onset and continue for 5–7 days: <ul style="list-style-type: none"> Valacyclovir 1 g PO three times a day (AII), or Famciclovir 500 mg PO three times a day (AII) <p><i>Severe or Complicated Cases</i></p> <ul style="list-style-type: none"> Acyclovir 10 mg/kg IV every 8 hours for 7–10 days (AIII) May switch to oral valacyclovir, famciclovir, or acyclovir after defervescence and clinical improvement if no evidence of visceral involvement (BIII). <p>Herpes Zoster (Shingles)</p> <ul style="list-style-type: none"> Initiate therapy as soon as possible and within 1 week of rash onset, or any time prior to full crusting of lesions (AIII). <p><i>Acute, Localized, Dermatomal</i></p> <ul style="list-style-type: none"> For 7–10 days. Consider longer duration if lesions are slow to resolve (CIII). Valacyclovir 1 g PO three times a day (AII), or Famciclovir 500 mg PO three times a day (AII) <p><i>Extensive Cutaneous Lesion or Visceral Involvement</i></p> <ul style="list-style-type: none"> Acyclovir 10 mg/kg IV every 8 hours until clinical improvement is evident (AII) 	<p>Primary Varicella Infection (Chickenpox)</p> <p><i>Uncomplicated Cases</i></p> <ul style="list-style-type: none"> Initiate as soon as possible after lesion onset and continue for 5–7 days: <ul style="list-style-type: none"> Acyclovir 800 mg PO five times a day (BII) <p>Herpes Zoster (Shingles)</p> <ul style="list-style-type: none"> Initiate therapy as soon as possible and within 1 week of rash onset, or any time prior to full crusting of lesions (AIII). <p><i>Acute, Localized, Dermatomal</i></p> <ul style="list-style-type: none"> For 7–10 days. Consider longer duration if lesions are slow to resolve (CIII). Acyclovir 800 mg PO five times a day (BII) <p>ARN</p> <p><i>Suppressive Therapy</i></p> <ul style="list-style-type: none"> Following initial therapy, acyclovir 800 mg PO twice daily (CIII) for ≥6 months 	<p>Consultation with an ophthalmologist experienced in the management of patients with VZV ocular disease is strongly recommended (AIII).</p> <p>People with V1 herpes zoster should have an ophthalmologic exam; patients with normal eye examinations initially should receive follow-up eye examinations, even after the skin lesions heal (AIII).</p> <p>All people with HIV should receive ART as soon as possible after diagnosis of HIV infection (AIII). The presence of disease caused by VZV is not an indication to defer or discontinue ART.</p>

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
	<ul style="list-style-type: none"> May switch to PO therapy (valacyclovir, famciclovir, or acyclovir) after clinical improvement (i.e., when no new vesicle formation and improvement of signs and symptoms of visceral VZV) to complete a total 10- to 14-day course (BIII). <p>Herpes Zoster Ophthalmicus</p> <p><i>Late Dendriform Lesions of the Corneal Epithelium</i></p> <ul style="list-style-type: none"> Oral antiviral treatment as stated above for "Acute, Localized, Dermatomal" herpes zoster, followed by suppressive therapy. If/when patient is not receiving oral antivirals, topical antivirals should be administered until resolution of lesions (AIII). <ul style="list-style-type: none"> Trifluridine 1% eye drops: see Mpox for dosing (BIII) Ganciclovir 0.15% gel: see HSV for dosing (BIII) <p><i>Stromal Keratitis and Anterior Uveitis</i></p> <ul style="list-style-type: none"> Oral antiviral treatment as stated above for "Acute, Localized, Dermatomal" herpes zoster, followed by suppressive therapy. Alongside initial systemic antiviral treatment, topical corticosteroids should be administered (AII). Typical regimen using prednisolone acetate 1% drops: 1 drop in affected eye every 2 hours while awake (maximum eight times daily) until clinical response, then slow taper over many weeks if clinical improvement continues, eventually decreasing to 1–2 drops daily for at least 1 year (AII). 		

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

Opportunistic Infection	Preferred Therapy	Alternative Therapy	Other Comments
	<p><i>Suppressive Therapy</i></p> <ul style="list-style-type: none"> Valacyclovir 1 g PO daily for 12 months to prevent development of new, or exacerbations of existing, keratitis lesions and uveitis (AII). <p>ARN</p> <p><i>Initial Therapy</i></p> <ul style="list-style-type: none"> Acyclovir 10 mg/kg IV every 8 hours for 10–14 days or until lesion healing (AIII), followed by suppressive therapy. A single adjunctive intravitreal injection of ganciclovir (2 mg/0.05 mL) can also be given as a part of induction treatment (BIII). Additional injections can be given if there is a concern for lack of treatment response, but injections should not be given more frequently than twice weekly (BIII). <p><i>Suppressive Therapy</i></p> <ul style="list-style-type: none"> Valacyclovir 1 g PO daily (AIII) for ≥6 months <p>PORN</p> <ul style="list-style-type: none"> Optimal antiviral therapy and duration of therapy remains undefined and should be managed by an ophthalmologist experienced in the management of VZV ocular disease (AIII). Acyclovir 10 mg/kg IV every 8 hours or ganciclovir 5 mg/kg IV every 12 hours (AIII), <i>plus</i> Intravitreal ganciclovir 2 mg/0.05 mL or intravitreal foscarnet 1.2 mg/0.05 mL weekly (BIII) 		

^a TAF 10-mg dose is in the FDC tablets of EVG/c/TAF/FTC and DRV/c/TAF/FTC; when TAF is used with other antiretrovirals, the dose is 25 mg.

^b Refer to [Daraprim Direct](#) for information on accessing pyrimethamine.

^c This regimen was not studied and is not recommended during pregnancy or breastfeeding or for people who are <40 kg or who have most types of extrapulmonary TB (other than pleural TB or lymphadenitis).

Table 2. Treatment of HIV-Associated Opportunistic Infections (Includes Recommendations for Acute Treatment and Secondary Prophylaxis/Chronic Suppressive/Maintenance Therapy)

^d Many patients with RIF resistance also have resistance to isoniazid. Susceptibility should be confirmed in any patient with RIF resistance to determine if isoniazid can be included in the treatment regimen.

^e Given the risk of ototoxicity and nephrotoxicity with aminoglycosides, use of amikacin should generally be restricted to bridging regimens while awaiting availability of less toxic medications and/or results of drug-susceptibility testing.

For information regarding the evidence ratings, refer to the [Rating System for Prevention and Treatment Recommendations](#) in the Introduction section of the Adult and Adolescent Opportunistic Infection Guidelines.

Key: +/- = with or without; 3TC = lamivudine; A-a = alveolar-arterial; AASLD = American Association for the Study of Liver Diseases; ACTG = AIDS Clinical Trials Group; ARN = acute retinal necrosis; ART = antiretroviral therapy; ARV = antiretroviral; CAP = community-acquired pneumonia; CD4 = CD4 T lymphocyte; CDC = Centers for Disease Control and Prevention; CDI = *Clostridium difficile* infection; CFU = colony-forming unit; CMV = cytomegalovirus; CNS = central nervous system; CrAg = cryptococcal antigen; CrCl = creatinine clearance; CSF = cerebrospinal fluid; CYP3A4 = cytochrome P450 3A4; DAA = direct-acting antiviral; DOR = doravirine; DOT = directly observed therapy; DLBCL = diffuse large B-cell lymphoma; DRV = darunavir; DRV/c = darunavir/cobicistat; DS = double strength; EIA = enzyme immunoassay; EMB = ethambutol; EPOCH = etoposide, prednisone, vincristine, cyclophosphamide, and doxorubicin combination therapy; EVG = elvitegravir; FDA = U.S. Food and Drug Administration; FDC = fixed-dose combination; FMT = fecal microbiota therapy; FTC = emtricitabine; G6PD = glucose-6-phosphate dehydrogenase; GI = gastrointestinal; HBsAg = hepatitis B surface antigen; HBV = hepatitis B virus; HCV = hepatitis C virus; HD = hemodialysis; HHV-8 = human herpesvirus 8; HPV = human papillomavirus; HSV = herpes simplex virus; ICP = intracranial pressure; IDSA = Infectious Diseases Society of America; IM = intramuscular; IND = investigational new drug; INH = isoniazid; IRIS = immune reconstitution inflammatory syndrome; IRU = immune recovery uveitis; IV = intravenous; KS = Kaposi sarcoma; KSHV = Kaposi sarcoma–associated herpesvirus; LFA = lateral flow assay; LP = lumbar puncture; MAC = *Mycobacterium avium* complex; MCD = multicentric Castleman's disease; MIC = minimum inhibitory concentration; MRSA = methicillin-resistant *Staphylococcus aureus*; MSM = men who have sex with men; NSAID = nonsteroidal anti-inflammatory drugs; OI = opportunistic infection; PaO₂ = partial pressure of oxygen; PCP = *Pneumocystis pneumonia*; PEL = primary effusion lymphoma; PML = progressive multifocal leukoencephalopathy; PO = oral; PORN = progressive outer retinal necrosis; PZA = pyrazinamide; RAS = resistance-associated substitution; RFB = rifabutin; RIF = rifampin; RPT = rifapentine; RPV = rilpivirine; SMX = sulfamethoxazole; SS = single strength; SVR = sustained virologic response; TAF = tenofovir alafenamide; TB = tuberculosis; TDF = tenofovir disoproxil fumarate; TMP = trimethoprim; TMP-SMX = trimethoprim-sulfamethoxazole; VIGIV = vaccinia immune globulin intravenous; VZV = varicella zoster virus; WHO = World Health Organization

Table 3. Indications for Discontinuing and Restarting Primary and Secondary Prophylaxis (or Chronic Maintenance Therapy) for Selected Opportunistic Infections in Adults and Adolescents With HIV

Updated: May 27, 2026

Reviewed: May 27, 2026

Opportunistic Infection	Indication for Discontinuing Primary Prophylaxis	Indication for Restarting Primary Prophylaxis	Indication for Discontinuing Secondary Prophylaxis/Chronic Maintenance Therapy	Indication for Restarting Secondary Prophylaxis/Chronic Maintenance Therapy
Bacterial Enteric Infections: Salmonellosis	Not applicable	Not applicable	Resolution of <i>Salmonella</i> infection and after response to ART with sustained viral suppression and CD4 counts >200 cells/mm ³ (CII)	No recommendation
Bartonellosis	Not applicable	Not applicable	<ul style="list-style-type: none"> Received at least 3–4 months of treatment, <i>and</i> CD4 count >200 cells/mm³ for ≥6 months (CIII) <p>Some specialists would only discontinue therapy if <i>Bartonella</i> titers have also decreased by fourfold (CIII).</p>	No recommendation
Candidiasis (Mucocutaneous)	Not applicable	Not applicable	If used, reasonable to discontinue when CD4 count >200 cells/mm ³ (AIII)	No recommendation
Coccidioidomycosis	CD4 count ≥250 cells/mm ³ with virologic suppression on ART (BIII)	No recommendation	<p>Focal Coccidioidal Pneumonia (AII)</p> <ul style="list-style-type: none"> Clinically responded to 3–6 months of antifungal therapy, with CD4 count ≥250 cells/mm³, and achieved viral suppression on ART Continue monitoring for recurrence after treatment discontinuation by using serial chest radiographs and coccidioidal serology. <p>Diffuse Pulmonary or Disseminated Non-Meningeal Disease (BIII)</p> <ul style="list-style-type: none"> Clinical and serological response to ≥12 months of therapy, <i>and</i> Consultation with experts 	No recommendation

Table 3. Indications for Discontinuing and Restarting Opportunistic Infection Secondary Prophylaxis or Chronic Maintenance in Adults and Adolescents With HIV

Opportunistic Infection	Indication for Discontinuing Primary Prophylaxis	Indication for Restarting Primary Prophylaxis	Indication for Discontinuing Secondary Prophylaxis/Chronic Maintenance Therapy	Indication for Restarting Secondary Prophylaxis/Chronic Maintenance Therapy
			<ul style="list-style-type: none"> For diffuse pulmonary disease, continue monitoring for recurrence after treatment discontinuation by using serial chest radiographs and coccidioidal serology. <p>Coccidioidal Meningitis (AII)</p> <ul style="list-style-type: none"> Suppressive therapy should be continued indefinitely, even with an increase in CD4 count on ART. 	
Cryptococcal Meningitis	Not applicable	Not applicable	<p>If the following criteria are fulfilled (BII):</p> <ul style="list-style-type: none"> Completed initial (induction and consolidation) therapy, <i>and</i> Received at least 1 year of antifungal therapy, <i>and</i> Remain asymptomatic of cryptococcal infection, <i>and</i> CD4 count ≥ 100 cells/mm³ and with suppressed plasma HIV RNA in response to ART 	CD4 count < 100 cells/mm ³ (AIII)
<i>Cystoisospora belli</i> Infection	Sustained increase in CD4 count to ≥ 200 cells/mm ³ for > 6 months in response to ART (BIII)	No recommendation	<ul style="list-style-type: none"> Sustained increase in CD4 count to ≥ 200 cells/mm³ for > 6 months in response to ART and without evidence of active <i>C. belli</i> infection (BIII) 	No recommendation

Table 3. Indications for Discontinuing and Restarting Opportunistic Infection Secondary Prophylaxis or Chronic Maintenance in Adults and Adolescents With HIV

Opportunistic Infection	Indication for Discontinuing Primary Prophylaxis	Indication for Restarting Primary Prophylaxis	Indication for Discontinuing Secondary Prophylaxis/Chronic Maintenance Therapy	Indication for Restarting Secondary Prophylaxis/Chronic Maintenance Therapy
Cytomegalovirus Retinitis	Not applicable	Not applicable	<p>If the following criteria are fulfilled (AII):</p> <ul style="list-style-type: none"> • CMV treatment for at least 3 months, <i>and</i> • Lesions are inactive, <i>and</i> • CD4 count ≥ 100 cells/mm³ for at least 3 months in response to ART <p>Therapy should be discontinued only after consultation with an ophthalmologist.</p> <p>After discontinuation of anti-CMV maintenance therapy, ophthalmologic monitoring for early detection of CMV relapse and IRU should be performed at least every 3 months and then yearly after immune reconstitution (AIII).</p>	CD4 count < 100 cells/mm ³ (AIII)
<i>Histoplasma capsulatum</i> Infection	On ART with CD4 count ≥ 150 cells/mm ³ for 6 months and with viral suppression on ART (BIII)	For patients at high risk of acquiring histoplasmosis (as noted in Table 1), restart if CD4 count decreases to < 150 cells/mm ³ (BIII).	<p>If the following criteria (AI) are fulfilled:</p> <ul style="list-style-type: none"> • Received azole therapy for > 1 year, <i>and</i> • Negative fungal blood cultures, <i>and</i> • Serum or urine <i>Histoplasma</i> antigen below the level of quantification, <i>and</i> • Viral suppression on ART, <i>and</i> • CD4 count ≥ 150 cells/mm³ for ≥ 6 months in response to ART 	CD4 count < 150 cells/mm ³ (BIII)
Leishmaniasis: Visceral (and possibly cutaneous leishmaniasis in immunocompromised patients with multiple relapses)	Not applicable	Not applicable	If CD4 count increases to > 350 cells/mm ³ and HIV viral load is suppressed for 6 months in response to ART and there is no evidence of clinical relapse of visceral leishmaniasis (CIII)	No recommendation
Microsporidiosis	Not applicable	Not applicable	If there are no signs or symptoms of non-ocular (BIII) or ocular (CIII) microsporidiosis and CD4 count is	No recommendation

Table 3. Indications for Discontinuing and Restarting Opportunistic Infection Secondary Prophylaxis or Chronic Maintenance in Adults and Adolescents With HIV

Opportunistic Infection	Indication for Discontinuing Primary Prophylaxis	Indication for Restarting Primary Prophylaxis	Indication for Discontinuing Secondary Prophylaxis/Chronic Maintenance Therapy	Indication for Restarting Secondary Prophylaxis/Chronic Maintenance Therapy
			>200 cells/mm ³ for >6 months in response to ART	
<i>Mycobacterium avium</i> Complex Disease	Continuing a fully suppressive ART regimen (AI)	CD4 count <50 cells/mm ³ and not on fully suppressive ART (AIII)	If the following criteria are fulfilled (AI): <ul style="list-style-type: none"> Completed ≥12 months of therapy, <i>and</i> Have no signs and symptoms of MAC disease, <i>and</i> Have sustained (≥6 months) CD4 count >100 cells/mm³ in response to ART 	If a fully suppressive ART regimen is not possible and CD4 count is consistently <100 cells/mm ³ (BIII)
<i>Pneumocystis</i> Pneumonia	CD4 count increased from <200 to ≥200 cells/mm ³ for ≥3 months in response to ART (AI) Can consider when CD4 count is 100–200 cells/mm ³ if HIV RNA remains below limits of detection for ≥3 to 6 months (BII)	CD4 count <100 cells/mm ³ regardless of HIV RNA level (AIII) CD4 count 100–200 cells/mm ³ and HIV RNA above detection limit of the assay (AIII)	CD4 count increased from <200 cells/mm ³ to ≥200 cells/mm ³ for ≥3 months in response to ART (AII) Can consider when CD4 count is 100–200 cells/mm ³ if HIV RNA remains below limits of detection for 3–6 months (BII) If PCP occurs at a CD4 count >200 cells/mm ³ while on ART, continue PCP prophylaxis for life, regardless of how high the CD4 cell count rises as a consequence of ART (BIII). If PCP occurs at a CD4 count >200 cells/mm ³ while not on ART, discontinuation of prophylaxis can be considered when HIV RNA levels are suppressed to below limits of detection for ≥3 to 6 months (CIII).	CD4 count <100 cells/mm ³ regardless of HIV RNA level (AIII) CD4 count 100–200 cells/mm ³ and with HIV RNA above detection limit of the assay (AIII)
Talaromycosis (Penicilliosis)	CD4 count ≥100 cells/mm ³ for ≥6 months in response to ART (BII) <i>or</i> HIV viral suppression for ≥6 months on ART (BIII)	CD4 count <100 cells/mm ³ (BIII) and still resides in or travels to the hyperendemic area	CD4 count ≥100 cells/mm ³ for ≥6 months in response to ART (BII) <i>or</i> HIV viral suppression for ≥6 months (BIII)	CD4 count <100 cells/mm ³ (BIII)

Table 3. Indications for Discontinuing and Restarting Opportunistic Infection Secondary Prophylaxis or Chronic Maintenance in Adults and Adolescents With HIV

Opportunistic Infection	Indication for Discontinuing Primary Prophylaxis	Indication for Restarting Primary Prophylaxis	Indication for Discontinuing Secondary Prophylaxis/Chronic Maintenance Therapy	Indication for Restarting Secondary Prophylaxis/Chronic Maintenance Therapy
<i>Toxoplasma gondii</i> Encephalitis	<p>CD4 count increased to >200 cells/mm³ for >3 months and sustained HIV RNA below limits of detection in response to ART (AI)</p> <p>Can consider when CD4 count is 100–200 cells/mm³ if HIV RNA remains below limits of detection for at least 3–6 months (BII)</p>	<p>CD4 count <100 cells/mm³ (AIII)</p> <p>CD4 count 100–200 cells/mm³ and with HIV RNA above detection limit of the assay (AIII)</p>	<p>If the following criteria are fulfilled (BI):</p> <ul style="list-style-type: none"> • Successfully completed initial therapy • Receiving maintenance therapy and remaining free of signs and symptoms of TE, <i>and</i> • CD4 count >200 cells/mm³ for >6 months in response to ART 	<p>CD4 count <200 cells/mm³ (AIII)</p>

For information regarding the evidence ratings, refer to the [Rating System for Prevention and Treatment Recommendations](#) in the Introduction section of the Adult and Adolescent Antiretroviral Guidelines.

Key: ART = antiretroviral therapy; CD4 = CD4 T lymphocyte; CMV = cytomegalovirus; IRU = immune reconstitution uveitis; MAC = *Mycobacterium avium* complex; PCP = *Pneumocystis pneumonia*; TE = *Toxoplasma encephalitis*

Table 4. Significant Pharmacokinetic Interactions Between Drugs Used to Treat or Prevent Opportunistic Infections

Updated: July 14, 2025

Reviewed: March 16, 2026

This table lists the known, predicted, or suspected pharmacokinetic (PK) interactions between drugs used for the treatment or prevention of HIV-associated opportunistic infections (OIs). Many of the drugs listed in this table may also interact with antiretroviral (ARV) drugs. Clinicians should refer to the [Drug–Drug Interactions](#) tables in the most current [Adult and Adolescent Antiretroviral Guidelines](#) to assess interaction potentials between OI drugs and ARV drugs.

Throughout the table, three recommendations are commonly used when concomitant administration of two drugs may lead to untoward consequences. The rationales for these recommendations are summarized below:

Do not coadminister.

There is either strong evidence or strong likelihood that the PK interaction cannot be managed with a dose modification of one or both drugs and will or may result in either—

- Increase in concentrations of one or both drugs, which may lead to excessive risk of toxicity; *or*
- Decrease in concentrations of one or both drugs, which may render one or both drugs ineffective.

Coadministration should be avoided, if possible.

There is a potential for significant PK interactions. If other more favorable options exist, clinicians are advised to consider changing components of the regimen to accommodate a safer or more effective regimen. However, coadministration of the drugs may be necessary when there are no other acceptable therapeutic options that provide a more favorable benefit-to-risk ratio. Therapeutic drug monitoring (TDM), if available, may facilitate any necessary dose adjustments.

Use with caution.

Drug combinations are recommended to be used with caution when—

- PK studies have shown a moderate degree of interaction of unknown clinical significance; *or*
- Based on the known metabolic pathway of the two drugs, there is a potential for PK interaction of unknown clinical significance.

Rifamycin-Related Induction Interactions

Rifamycin antibiotics are potent inducers of Phase 1 and Phase 2 drug-metabolizing reactions. They also affect various transporters. When a rifamycin antibiotic must be combined with an interacting drug, close monitoring for clinical efficacy of the coadministered agent is advised. TDM, if available, may facilitate any necessary dose adjustments.

- *Rifampin (also known as rifampicin):* Interactions may not be apparent in the first several days of rifampin therapy. However, with daily doses of rifampin, enzyme induction increases over a week or more. Based on

limited data, larger daily doses of rifampin (e.g., 1,200 mg or more) appear to produce about the same maximum induction as lower doses, but the induction effect occurs more rapidly.^{1,2}

- *Rifabutin*: In general, rifabutin as a cytochrome P450 (CYP) 3A4 inducer is about 40% of the potency of rifampin, but this can vary by substrate and enzymatic reaction.³ Rifabutin is also a substrate of CYP3A4 (unlike rifampin and rifapentine) and may be subject to changes in drug exposure when given concomitantly with 3A4 inhibitors or inducers. When used with interacting drug(s), rifabutin dosage modification, TDM, and/or more frequent monitoring for rifabutin-related toxicities may be needed.
- *Rifapentine*: In general, daily rifapentine is at least as potent an inducer as rifampin. However, the potential for drug interactions with once-weekly rifapentine is not well studied. Reduced exposure of concurrent drugs that are CYP3A4 substrates is likely to occur with once-weekly rifapentine, with the extent varying by drug.

Following discontinuation of rifamycins, the enzyme induction effects gradually diminish over time and vary depending on the drug's half-life, the time required to achieve maximal induction, and the degradation course of upregulated enzymes. Generally, after five half-lives, a drug is substantially eliminated from the body. Though rifampin has a short plasma half-life (3–5 hours), de-induction largely depends on the decay time of enzymes produced.^{4,5} A 2-week interval after the final dose of rifampin was found sufficient for enzyme levels to return to baseline.⁴ Rifapentine and rifabutin, characterized by longer half-lives (approximately 13 and 45 hours, respectively), may exhibit a more prolonged de-induction period than rifampin. Notably, rifabutin induces enzymes to a lesser extent than rifampin and rifapentine, necessitating a shorter de-induction phase.

Azole- and Macrolide-Related Inhibition Interactions

Azole antifungals—including fluconazole, isavuconazole, itraconazole, posaconazole, and voriconazole—are substrates and potent inhibitors of metabolic pathways, including CYP enzymes and/or drug transporters (e.g., p-glycoprotein). Interactions involving azole antifungals are common. When an azole antifungal must be combined with an interacting drug, close monitoring for clinical toxicity and efficacy of the azole and/or the coadministered agent may be needed. TDM, if available, may facilitate any necessary dose adjustments.

The newer azole antifungal oteseconazole is less prone to cause clinically significant drug–drug interactions. Oteseconazole does not undergo significant metabolism, and its drug interaction profile is limited to its ability to inhibit the Breast Cancer Resistance Protein (BCRP). Concomitant use of oteseconazole and BCRP substrates may increase the exposure of BCRP substrates.

Macrolides have been shown to form complexes with drug-oxidizing enzymes, including CYP enzymes, which render an inhibitory effect. In general, erythromycin and clarithromycin are moderate to strong inhibitors, whereas azithromycin's propensity for causing clinically relevant drug interactions is the lowest, as it does not form complexes with CYP enzymes that lead to enzyme inactivation.

Pharmacodynamic Interactions

Pharmacodynamic interactions are not addressed in this table. For example, many of the drug classes listed below independently possess a risk for QTc prolongation, including azoles, macrolides, and certain anti-tuberculosis and antimalarial medications. Coadministration of drugs in these classes may require monitoring for QTc prolongation, particularly in patients with predisposing risk factors.

Therapeutic Drug Monitoring

Drug interactions can alter oral absorption or systemic clearance of drugs. More than one interaction can occur at the same time, with potentially opposing effects. TDM, if available, may facilitate any necessary dose adjustments when

interacting drugs are coadministered. TDM allows the clinician to make informed, individualized decisions about dose adjustments that are more precise than standardized dose adjustments based upon anticipated, average effects. When available, “therapeutic ranges” are based on dose-ranging studies that have evaluated clinical outcomes. These ranges are proven to be predictive of efficacy or toxicity. When such data are not available, “normal ranges” are used to represent the drug exposure generally achieved with a standard dose of a drug. Excursions from “normal concentrations” might be associated with decreased efficacy (low concentrations) or increased toxicity (high concentrations), but specific data proving these risks are lacking. In such situations, clinicians should weigh the potential risks and benefits based upon TDM data. Consultations with experts for those drugs may be helpful.

TDM may be particularly useful in the following situations:

- Inadequate therapeutic response
- Overt toxicity
- Risk of serious drug–drug interactions
- Impaired drug absorption

In these cases, TDM can confirm the adequacy of the doses or suggest alternative doses that might lead to superior outcomes.

When TDM is desired, clinicians should contact their clinical laboratory to determine assay availability and turnaround time for their institution. Drugs in this table that are known to have assays (for clinical and/or research purposes) available within the United States and typically in Europe include the following:

- | | | | | |
|------------------|-----------------|----------------|---------------|----------------|
| • Atovaquone | • Dapsone | • Itraconazole | • Quinine | • Sofosbuvir |
| • Bedaquiline | • Doxycycline | • Linezolid | • Rifabutin | • Tenofovir |
| • Chloroquine | • Fluconazole | • Mefloquine | • Rifampin | • Voriconazole |
| • Clarithromycin | • Isavuconazole | • Posaconazole | • Rifapentine | |

Table 4. Significant Pharmacokinetic Interactions Between Drugs Used to Treat or Prevent Opportunistic Infections

Note: To avoid redundancy, drug–drug interactions are listed only once by primary drug (listed alphabetically). Subsequently, when an interacting agent becomes the primary drug, guideline users are referred to the entry for the initial primary drug. See the Clarithromycin row for the first example of this format.

Primary Drug	Interacting Agent	Effect on Primary and/or Concomitant Drug Concentrations	Recommendations
Artemether/ Lumefantrine	Clarithromycin	↑ lumefantrine expected	Coadministration should be avoided, if possible. Consider azithromycin in place of clarithromycin.
	Erythromycin	↑ lumefantrine expected	Coadministration should be avoided, if possible. Consider azithromycin in place of erythromycin.
	Fluconazole	↑ lumefantrine possible	Coadministration should be avoided, if possible. If coadministered, monitor for lumefantrine toxicities.
	Isavuconazole	↑ lumefantrine possible	Coadministration should be avoided, if possible. If coadministered, monitor for lumefantrine toxicities.
	Itraconazole	↑ lumefantrine expected	Coadministration should be avoided, if possible. If coadministered, monitor for lumefantrine toxicities.
	Mefloquine	↓ lumefantrine possible	If mefloquine is administered immediately before artemether/lumefantrine, monitor for decreased efficacy of artemether/lumefantrine and encourage food intake.
	Posaconazole	↑ lumefantrine expected	Coadministration should be avoided, if possible. If coadministered, monitor for lumefantrine toxicities.
	Rifabutin ^a	↓ artemether, DHA, and lumefantrine expected	Use with caution. Monitor for antimalarial efficacy.
	Rifampin ^a	Artemether AUC ↓ 89% DHA AUC ↓ 85% Lumefantrine AUC ↓ 68%	Do not coadminister.
	Rifapentine ^a	Daily and Weekly Rifapentine ↓ artemether, DHA, and lumefantrine expected	Do not coadminister.

Table 4. Significant Pharmacokinetic Interactions Between Drugs Used to Treat or Prevent Opportunistic Infections

Primary Drug	Interacting Agent	Effect on Primary and/or Concomitant Drug Concentrations	Recommendations
	Voriconazole	↑ lumefantrine expected	Coadministration should be avoided, if possible. If coadministered, monitor for lumefantrine toxicities.
Atovaquone	Doxycycline	Atovaquone concentration ↓ approximately equal to 40% with tetracycline No interaction study with doxycycline	Dose adjustment not established; if coadministered, instruct patient to take atovaquone with fatty meal and monitor for decreased atovaquone efficacy.
	Rifabutin ^a	Atovaquone C _{ss} ↓ 34% Rifabutin C _{ss} ↓ 19%	Dose adjustment not established; if coadministered, instruct patient to take atovaquone with fatty meal and monitor for decreased atovaquone efficacy.
	Rifampin ^a	Atovaquone C _{ss} ↓ 52% Rifampin C _{ss} ↑ 37%	Do not coadminister.
	Rifapentine ^a	Daily and Weekly Rifapentine ↓ atovaquone expected	Do not coadminister.
Bedaquiline	Clarithromycin	↑ bedaquiline expected	Do not coadminister. Consider azithromycin in place of clarithromycin.
	Erythromycin	↑ bedaquiline expected	Do not coadminister. Consider azithromycin in place of erythromycin.
	Fluconazole	↑ bedaquiline possible	Coadministration should be avoided, if possible. If coadministered, monitor for bedaquiline toxicities.
	Isavuconazole	↑ bedaquiline possible	Coadministration should be avoided, if possible. If coadministered, monitor for bedaquiline toxicities.
	Itraconazole	↑ bedaquiline expected	Coadministration should be avoided, if possible. If coadministered, monitor for bedaquiline toxicities. If coadministration is required for >14 days, weigh the benefits of therapy against the risks of bedaquiline toxicities.

Table 4. Significant Pharmacokinetic Interactions Between Drugs Used to Treat or Prevent Opportunistic Infections

Primary Drug	Interacting Agent	Effect on Primary and/or Concomitant Drug Concentrations	Recommendations
	Posaconazole	↑ bedaquiline expected	Coadministration should be avoided, if possible. If coadministered, monitor for bedaquiline toxicities.
	Rifabutin ^a	↔ bedaquiline ↓ rifabutin possible	If coadministered, separate time of administration; perform rifabutin TDM and adjust dose accordingly.
	Rifampin ^a	Bedaquiline AUC ↓ 53%	Do not coadminister.
	Rifapentine ^a	Daily Rifapentine Bedaquiline AUC ↓ 55% Weekly Rifapentine ↓ bedaquiline expected	Do not coadminister.
	Voriconazole	↑ bedaquiline expected	Coadministration should be avoided, if possible. If coadministered, monitor for bedaquiline toxicities.
Brincidofovir	Clarithromycin	↑ brincidofovir expected	Coadministration should be avoided, if possible. If coadministered, postpone clarithromycin for at least 3 hours after brincidofovir and monitor for brincidofovir toxicities. Consider azithromycin in place of clarithromycin.
	Erythromycin	↑ brincidofovir expected	Coadministration should be avoided, if possible. If coadministered, postpone erythromycin for at least 3 hours after brincidofovir and monitor for brincidofovir toxicities. Consider azithromycin in place of erythromycin.
	Rifampin ^a	↑ brincidofovir expected	Coadministration should be avoided, if possible. If coadministered, postpone rifampin for at least 3 hours after brincidofovir and monitor for brincidofovir toxicities.
Caspofungin	Rifabutin ^a	↓ caspofungin possible	Monitor for antifungal efficacy. Dose not established. Consider increasing caspofungin dose to 70 mg/day or switch to another echinocandin (e.g., micafungin or anidulafungin).

Table 4. Significant Pharmacokinetic Interactions Between Drugs Used to Treat or Prevent Opportunistic Infections

Primary Drug	Interacting Agent	Effect on Primary and/or Concomitant Drug Concentrations	Recommendations
	Rifampin ^a	Caspofungin C _{min} ↓ 30%	If coadministered, caspofungin dose should be increased to 70 mg/day. Consider alternative echinocandin (e.g., micafungin or anidulafungin).
	Rifapentine ^a	Daily Rifapentine ↓ caspofungin expected Weekly Rifapentine ↓ caspofungin possible	Monitor for antifungal efficacy. Dose not established. Consider increasing caspofungin dose to 70 mg/day or switch to another echinocandin (e.g., micafungin or anidulafungin).
Chloroquine	Clarithromycin	↑ chloroquine expected	Do not coadminister. Consider azithromycin in place of clarithromycin.
	Erythromycin	↑ chloroquine expected	Do not coadminister. Consider azithromycin in place of erythromycin.
	Fluconazole	↑ chloroquine possible	Coadministration should be avoided, if possible. If coadministered, monitor for chloroquine toxicities.
	Isavuconazole	↑ chloroquine possible	Coadministration should be avoided, if possible. If coadministered, monitor for chloroquine toxicities.
	Itraconazole	↑ chloroquine expected	Coadministration should be avoided, if possible. If coadministered, monitor for chloroquine toxicities.
	Posaconazole	↑ chloroquine expected	Coadministration should be avoided, if possible. If coadministered, monitor for chloroquine toxicities.
	Rifabutin ^a	↓ chloroquine expected	Monitor for chloroquine efficacy.
	Rifampin ^a	↓ chloroquine expected	Monitor for chloroquine efficacy.
	Rifapentine ^a	Daily and Weekly Rifapentine ↓ chloroquine expected	Monitor for chloroquine efficacy.
	Voriconazole	↑ chloroquine expected	Coadministration should be avoided, if possible. If coadministered, monitor for chloroquine toxicities.
Clarithromycin	Artemether/Lumefantrine	See Artemether/Lumefantrine.	See Artemether/Lumefantrine.
	Bedaquiline	See Bedaquiline.	See Bedaquiline.
	Chloroquine	See Chloroquine.	See Chloroquine.

Table 4. Significant Pharmacokinetic Interactions Between Drugs Used to Treat or Prevent Opportunistic Infections

Primary Drug	Interacting Agent	Effect on Primary and/or Concomitant Drug Concentrations	Recommendations
	Fluconazole	Clarithromycin AUC ↑ 18% and C_{min} ↑ 33%	No dose adjustment necessary in patients with normal renal function. Monitor for clarithromycin toxicity.
	Ibexafungerp	See Ibexafungerp.	See Ibexafungerp.
	Isavuconazole	↑ isavuconazole and clarithromycin expected	Coadministration should be avoided, if possible. Consider azithromycin in place of clarithromycin. If coadministered, monitor for toxicities of both isavuconazole and clarithromycin. Role of isavuconazole TDM has not been established.
	Itraconazole	↑ itraconazole and clarithromycin expected	Coadministration should be avoided, if possible. Consider azithromycin in place of clarithromycin. If coadministered, monitor for toxicities of both itraconazole and clarithromycin; perform itraconazole and clarithromycin TDM and adjust dose accordingly.
	Mefloquine	↑ mefloquine expected	Use with caution. Consider azithromycin in place of clarithromycin. If coadministered, monitor for mefloquine toxicity.
	Posaconazole	↑ clarithromycin expected	Coadministration should be avoided, if possible. Consider azithromycin in place of clarithromycin. If coadministered, monitor for toxicities of clarithromycin; perform clarithromycin TDM and adjust dose accordingly.
	Quinine	↑ quinine expected ↑ clarithromycin possible	Do not coadminister. Consider azithromycin in place of clarithromycin.
	Rifabutin ^a	Clarithromycin AUC ↓ 44% 14-OH clarithromycin AUC ↑ 57% Rifabutin AUC ↑ 76% to 99% des-rifabutin AUC ↑ 375%	Use with caution. Consider azithromycin in place of clarithromycin. If coadministered, consider reducing rifabutin dose, perform clarithromycin and rifabutin TDM and adjust dose accordingly. Monitor for rifabutin toxicities.

Table 4. Significant Pharmacokinetic Interactions Between Drugs Used to Treat or Prevent Opportunistic Infections

Primary Drug	Interacting Agent	Effect on Primary and/or Concomitant Drug Concentrations	Recommendations
	Rifampin ^a	Clarithromycin concentration ↓ 87% Rifampin AUC ↑ 60%	Do not coadminister. Use azithromycin in place of clarithromycin.
	Rifapentine ^a	Daily and Weekly Rifapentine ↓ clarithromycin expected ↑ 14-OH clarithromycin and rifapentine expected	Daily Rifapentine Do not coadminister. Use azithromycin in place of clarithromycin. Weekly Rifapentine Use with caution. Consider azithromycin in place of clarithromycin. If coadministered, monitor for rifapentine toxicities and clarithromycin efficacy; perform clarithromycin and rifapentine TDM and adjust doses accordingly.
	Voriconazole	↑ clarithromycin expected	Coadministration should be avoided, if possible. Consider azithromycin in place of clarithromycin. If coadministered, monitor for toxicities of clarithromycin; perform clarithromycin TDM and adjust dose accordingly.
Dapsone	Rifabutin ^a	Dapsone AUC ↓ 27% to 40%	Coadministration should be avoided, if possible. Consider alternatives for dapsone.
	Rifampin ^a	Dapsone concentration ↓ sevenfold to tenfold and $t_{1/2}$ ↓ from 24 hours to 11 hours	Coadministration should be avoided, if possible. Consider alternatives for dapsone.
	Rifapentine ^a	Daily and Weekly Rifapentine ↓ dapsone expected	Coadministration should be avoided, if possible. Consider alternatives for dapsone.
Doxycycline	Atovaquone	See Atovaquone.	See Atovaquone.
	Rifabutin ^a	↓ doxycycline possible	Monitor closely for doxycycline efficacy or consider alternative therapy.

Table 4. Significant Pharmacokinetic Interactions Between Drugs Used to Treat or Prevent Opportunistic Infections

Primary Drug	Interacting Agent	Effect on Primary and/or Concomitant Drug Concentrations	Recommendations
	Rifampin ^a	Doxycycline AUC ↓ 59%	Use with caution. Monitor closely for doxycycline efficacy or consider alternative therapy.
	Rifapentine ^a	Daily Rifapentine ↓ doxycycline expected Weekly Rifapentine ↓ doxycycline possible	Use with caution. Monitor closely for doxycycline efficacy or consider alternative therapy.
Erythromycin	Artemether/Lumefantrine	See Artemether/Lumefantrine.	See Artemether/Lumefantrine.
	Bedaquiline	See Bedaquiline.	See Bedaquiline.
	Chloroquine	See Chloroquine.	See Chloroquine.
	Fluconazole	↑ erythromycin possible	Do not coadminister. Consider azithromycin in place of erythromycin.
	Ibexafungerp	See Ibexafungerp.	See Ibexafungerp.
	Isavuconazole	↑ erythromycin and isavuconazole possible	Do not coadminister. Consider azithromycin in place of erythromycin.
	Itraconazole	Itraconazole AUC ↑ 36% ↑ erythromycin possible	Do not coadminister. Consider azithromycin in place of erythromycin.
	Mefloquine	↑ mefloquine possible	Do not coadminister. Consider azithromycin in place of erythromycin.
	Posaconazole	↑ erythromycin expected	Do not coadminister. Consider azithromycin in place of erythromycin.
	Quinine	↑ quinine expected ↑ erythromycin possible	Do not coadminister. Consider azithromycin in place of erythromycin.
	Rifabutin ^a	↓ erythromycin possible ↑ rifabutin possible	Use with caution. Consider azithromycin in place of erythromycin. If coadministered, monitor for erythromycin efficacy and rifabutin toxicities; perform rifabutin TDM and adjust dose accordingly.
	Rifampin ^a	↓ erythromycin expected	Consider azithromycin in place of erythromycin. If coadministered, monitor for erythromycin efficacy.

Table 4. Significant Pharmacokinetic Interactions Between Drugs Used to Treat or Prevent Opportunistic Infections

Primary Drug	Interacting Agent	Effect on Primary and/or Concomitant Drug Concentrations	Recommendations
	Rifapentine ^a	Daily and Weekly Rifapentine ↓ erythromycin expected	Consider azithromycin in place of erythromycin. If coadministered, monitor for erythromycin efficacy.
	Voriconazole	↑ erythromycin expected	Do not coadminister. Consider azithromycin in place of erythromycin.
Fluconazole	Artemether/Lumefantrine	See Artemether/Lumefantrine.	See Artemether/Lumefantrine.
	Bedaquiline	See Bedaquiline.	See Bedaquiline.
	Chloroquine	See Chloroquine.	See Chloroquine.
	Clarithromycin	See Clarithromycin.	See Clarithromycin.
	Erythromycin	See Erythromycin.	See Erythromycin.
	Mefloquine	↑ mefloquine possible	Coadministration should be avoided, if possible. If coadministered, monitor for mefloquine toxicities.
	Quinine	↑ quinine expected ↑ fluconazole possible	Coadministration should be avoided, if possible. If coadministered, monitor for quinine and fluconazole toxicity.
	Rifabutin ^a	Rifabutin AUC ↑ 80% ↔ fluconazole expected	Use with caution. Monitor for rifabutin toxicities. Perform rifabutin TDM; may need to decrease rifabutin dose to 150 mg/day.
	Rifampin ^a	Fluconazole AUC ↓ 23% to 56%	Monitor for antifungal efficacy; may need to increase fluconazole dose.
Glecaprevir/ Pibrentasvir	Rifapentine ^a	Daily and Weekly Rifapentine ↓ fluconazole expected	Monitor for antifungal efficacy; may need to increase fluconazole dose.
	Rifabutin ^a	↓ glecaprevir and pibrentasvir possible	Coadministration should be avoided, if possible. Consider alternative agents.
	Rifampin ^a	Glecaprevir AUC ↓ 88% Pibrentasvir AUC ↓ 87%	Do not coadminister.
	Rifapentine ^a	Daily and Weekly Rifapentine ↓ glecaprevir and pibrentasvir expected	Do not coadminister. Consider alternative agents.
	TDF	TFV AUC ↑ 29% when coadministered as EFV/TDF/FTC	Use usual dose. Monitor renal function or consider TAF.

Table 4. Significant Pharmacokinetic Interactions Between Drugs Used to Treat or Prevent Opportunistic Infections

Primary Drug	Interacting Agent	Effect on Primary and/or Concomitant Drug Concentrations	Recommendations
	TAF	↔ TFV concentration when coadministered as EVG/c/TAF/FTC	No dose adjustment necessary.
Ibexafungerp	Clarithromycin	↑ Ibexafungerp expected	Decrease ibexafungerp dose to 150 mg twice daily for 1 day.
	Erythromycin	↑ Ibexafungerp expected	Decrease ibexafungerp dose to 150 mg twice daily for 1 day.
	Itraconazole	↑ Ibexafungerp expected	Decrease ibexafungerp dose to 150 mg twice daily for 1 day.
	Posaconazole	↑ Ibexafungerp expected	Decrease ibexafungerp dose to 150 mg twice daily for 1 day.
	Rifabutin ^a	↓ Ibexafungerp expected	Do not coadminister.
	Rifampin ^a	↓ Ibexafungerp expected	Do not coadminister.
	Rifapentine ^a	Daily and Weekly Rifapentine ↓ Ibexafungerp expected	Do not coadminister.
	Voriconazole	↑ Ibexafungerp expected	Decrease ibexafungerp dose to 150 mg twice daily for 1 day.
Isavuconazole	Artemether/Lumefantrine	See Artemether/Lumefantrine.	See Artemether/Lumefantrine.
	Bedaquiline	See Bedaquiline.	See Bedaquiline.
	Chloroquine	See Chloroquine.	See Chloroquine.
	Clarithromycin	See Clarithromycin.	See Clarithromycin.
	Erythromycin	See Erythromycin.	See Erythromycin.
	Mefloquine	↑ mefloquine expected	Coadministration should be avoided, if possible. If coadministered, monitor for mefloquine toxicities.
	Quinine	↑ quinine expected ↑ isavuconazole possible	Coadministration should be avoided, if possible. If coadministered, monitor for quinine and isavuconazole toxicities.
	Rifabutin ^a	↓ isavuconazole expected ↑ rifabutin expected	Consider alternative agent(s). If alternative agents are not available, use with close monitoring for isavuconazole antifungal activity and rifabutin toxicity. Perform rifabutin and isavuconazole TDM and adjust dose accordingly.

Table 4. Significant Pharmacokinetic Interactions Between Drugs Used to Treat or Prevent Opportunistic Infections

Primary Drug	Interacting Agent	Effect on Primary and/or Concomitant Drug Concentrations	Recommendations
	Rifampin ^a	Isavuconazole AUC ↓ 97%	Do not coadminister. Consider alternative antifungal and/or antimycobacterial agent(s).
	Rifapentine ^a	Daily and Weekly Rifapentine ↓ isavuconazole expected	Do not coadminister. Consider alternative antifungal and/or antimycobacterial agent(s).
Itraconazole	Artemether/Lumefantrine	See Artemether/Lumefantrine.	See Artemether/Lumefantrine.
	Bedaquiline	See Bedaquiline.	See Bedaquiline.
	Chloroquine	See Chloroquine.	See Chloroquine.
	Clarithromycin	See Clarithromycin.	See Clarithromycin.
	Erythromycin	See Erythromycin.	See Erythromycin.
	Ibexafungerp	See Ibexafungerp.	See Ibexafungerp.
	Mefloquine	↑ mefloquine expected	Coadministration should be avoided, if possible. If coadministered, monitor for mefloquine toxicities.
	Quinine	↑ quinine expected ↑ itraconazole possible	Coadministration should be avoided, if possible. If coadministered, monitor for quinine and itraconazole toxicities; perform itraconazole TDM and adjust dose accordingly.
	Rifabutin ^a	Itraconazole AUC ↓ 70% ↑ rifabutin expected	Do not coadminister. Consider alternative antifungal and/or antimycobacterial agent(s).
	Rifampin ^a	Itraconazole AUC ↓ 64% to 88%	Do not coadminister. Consider alternative antifungal and/or antimycobacterial agent(s).
	Rifapentine ^a	Daily and Weekly Rifapentine ↓ itraconazole expected	Do not coadminister. Consider alternative antifungal and/or antimycobacterial agent(s).
Linezolid	Rifabutin ^a	↓ linezolid possible	Monitor for linezolid efficacy.
	Rifampin ^a	Linezolid AUC ↓ 32%	Monitor for linezolid efficacy. Perform linezolid TDM and adjust dose accordingly.
	Rifapentine ^a	Daily Rifapentine ↓ linezolid expected	Daily Rifapentine Monitor for linezolid efficacy. Perform linezolid TDM and adjust dose accordingly.

Table 4. Significant Pharmacokinetic Interactions Between Drugs Used to Treat or Prevent Opportunistic Infections

Primary Drug	Interacting Agent	Effect on Primary and/or Concomitant Drug Concentrations	Recommendations
		Weekly Rifapentine ↓ linezolid possible	Weekly Rifapentine Monitor for linezolid efficacy.
Mefloquine	Artemether/Lumefantrine	See Artemether/Lumefantrine.	See Artemether/Lumefantrine.
	Clarithromycin	See Clarithromycin.	See Clarithromycin.
	Erythromycin	See Erythromycin.	See Erythromycin.
	Fluconazole	See Fluconazole.	See Fluconazole.
	Isavuconazole	See Isavuconazole.	See Isavuconazole.
	Itraconazole	See Itraconazole.	See Itraconazole.
	Posaconazole	↑ mefloquine expected	Coadministration should be avoided, if possible. If coadministered, monitor for mefloquine toxicities.
	Rifabutin ^a	↓ mefloquine possible	Monitor for mefloquine efficacy.
	Rifampin ^a	Mefloquine AUC ↓ 68%	Do not coadminister. Use alternative antimalarial drug or rifabutin.
	Rifapentine ^a	Daily and Weekly Rifapentine ↓ mefloquine expected	Do not coadminister. Use alternative antimalarial drug or rifabutin.
	Voriconazole	↑ mefloquine expected	Coadministration should be avoided, if possible. If coadministered, monitor for mefloquine toxicities.
Posaconazole	Artemether/Lumefantrine	See Artemether/Lumefantrine.	See Artemether/Lumefantrine.
	Bedaquiline	See Bedaquiline.	See Bedaquiline.
	Chloroquine	See Chloroquine.	See Chloroquine.
	Clarithromycin	See Clarithromycin.	See Clarithromycin.
	Erythromycin	See Erythromycin.	See Erythromycin.
	Ibexafungerp	See Ibexafungerp.	See Ibexafungerp.
	Mefloquine	See Mefloquine.	See Mefloquine.
	Quinine	↑ quinine expected ↑ posaconazole possible	Coadministration should be avoided, if possible. If coadministered, monitor for quinine toxicities.

Table 4. Significant Pharmacokinetic Interactions Between Drugs Used to Treat or Prevent Opportunistic Infections

Primary Drug	Interacting Agent	Effect on Primary and/or Concomitant Drug Concentrations	Recommendations
	Rifabutin ^a	Posaconazole AUC ↓ 49% Rifabutin AUC ↑ 72%	Coadministration should be avoided, if possible. If coadministered, perform posaconazole and rifabutin TDM and adjust doses accordingly; monitor for clinical response to posaconazole and rifabutin toxicities.
	Rifampin ^a	↓ posaconazole expected	Do not coadminister when treating invasive fungal infections. If coadministered for treatment of noninvasive fungal infections, perform posaconazole TDM and adjust dose accordingly; monitor for clinical response.
	Rifapentine ^a	Daily and Weekly Rifapentine ↓ posaconazole expected	Daily Rifapentine Do not coadminister when treating invasive fungal infections. If coadministered for treatment of noninvasive fungal infections, perform posaconazole TDM and adjust dose accordingly; monitor for clinical response. Weekly Rifapentine Coadministration should be avoided, if possible. If coadministered, perform posaconazole TDM and adjust dose accordingly; monitor clinical response.
Quinine	Clarithromycin	See Clarithromycin.	See Clarithromycin.
	Erythromycin	See Erythromycin.	See Erythromycin.
	Fluconazole	See Fluconazole.	See Fluconazole.
	Itraconazole	See Itraconazole.	See Itraconazole.
	Posaconazole	See Posaconazole.	See Posaconazole.
	Rifabutin ^a	↓ quinine possible ↑ rifabutin possible	Monitor for quinine efficacy. Monitor for rifabutin toxicity.
	Rifampin ^a	Quinine AUC ↓ 75% to 85%	Do not coadminister.
	Rifapentine ^a	Daily and Weekly Rifapentine ↓ quinine expected	Do not coadminister.

Table 4. Significant Pharmacokinetic Interactions Between Drugs Used to Treat or Prevent Opportunistic Infections

Primary Drug	Interacting Agent	Effect on Primary and/or Concomitant Drug Concentrations	Recommendations
	Voriconazole	↑ quinine expected	Coadministration should be avoided, if possible. If coadministered, monitor for quinine toxicities.
Rifabutin ^a	Artemether/Lumefantrine	See Artemether/Lumefantrine.	See Artemether/Lumefantrine.
	Atovaquone	See Atovaquone.	See Atovaquone.
	Bedaquiline	See Bedaquiline.	See Bedaquiline.
	Caspofungin	See Caspofungin.	See Caspofungin.
	Chloroquine	See Chloroquine.	See Chloroquine.
	Clarithromycin	See Clarithromycin.	See Clarithromycin.
	Dapsone	See Dapsone.	See Dapsone.
	Doxycycline	See Doxycycline.	See Doxycycline.
	Erythromycin	See Erythromycin.	See Erythromycin.
	Fluconazole	See Fluconazole.	See Fluconazole.
	Glecaprevir/Pibrentasvir	See Glecaprevir/Pibrentasvir.	See Glecaprevir/Pibrentasvir.
	Ibexafungerp	See Ibexafungerp.	See Ibexafungerp.
	Isavuconazole	See Isavuconazole.	See Isavuconazole.
	Itraconazole	See Itraconazole.	See Itraconazole.
	Linezolid	See Linezolid.	See Linezolid.
	Mefloquine	See Mefloquine.	See Mefloquine.
	Posaconazole	See Posaconazole.	See Posaconazole.
	Quinine	See Quinine.	See Quinine.
	Sofosbuvir/Velpatasvir	↓ velpatasvir, sofosbuvir expected	Do not coadminister.
	Tedizolid	↓ tedizolid possible	Monitor for tedizolid efficacy.
	TAF	↓ TAF, TFV, TFV-DP expected ↑ TFV-DP expected versus TDF alone	If coadministered, monitor for HIV and HBV treatment efficacy. Note: Interpretation extrapolated from TAF and rifampin (see Rifampin). FDA labeling recommends not to coadminister.
	TDF	↔ TDF, TFV, TFV-DP expected	No dosage adjustment necessary.

Table 4. Significant Pharmacokinetic Interactions Between Drugs Used to Treat or Prevent Opportunistic Infections

Primary Drug	Interacting Agent	Effect on Primary and/or Concomitant Drug Concentrations	Recommendations
	Voriconazole	Voriconazole AUC ↓ 79% Rifabutin AUC ↑ 4-fold	Do not coadminister. Consider alternative antifungal and/or antimycobacterial agent(s). Coadministration may be considered if both voriconazole and rifabutin TDM are available to guide therapy.
Rifampin ^a	Artemether/Lumefantrine	See Artemether/Lumefantrine.	See Artemether/Lumefantrine.
	Atovaquone	See Atovaquone.	See Atovaquone.
	Bedaquiline	See Bedaquiline.	See Bedaquiline.
	Caspofungin	See Caspofungin.	See Caspofungin.
	Chloroquine	See Chloroquine.	See Chloroquine.
	Clarithromycin	See Clarithromycin.	See Clarithromycin.
	Dapsone	See Dapsone.	See Dapsone.
	Doxycycline	See Doxycycline.	See Doxycycline.
	Erythromycin	See Erythromycin.	See Erythromycin.
	Fluconazole	See Fluconazole.	See Fluconazole.
	Glecaprevir/Pibrentasvir	See Glecaprevir/Pibrentasvir.	See Glecaprevir/Pibrentasvir.
	Ibexafungerp	See Ibexafungerp.	See Ibexafungerp.
	Isavuconazole	See Isavuconazole.	See Isavuconazole.
	Itraconazole	See Itraconazole.	See Itraconazole.
	Linezolid	See Linezolid.	See Linezolid.
	Mefloquine	See Mefloquine.	See Mefloquine.
	Posaconazole	See Posaconazole.	See Posaconazole.
	Quinine	See Quinine.	See Quinine.
	Sofosbuvir/Velpatasvir	Sofosbuvir AUC ↓ 72% Velpatasvir AUC ↓ 82%	Do not coadminister.
	Tedizolid	Tedizolid AUC ↓ 20%	Monitor for tedizolid efficacy.
	TAF	TAF Plus Rifampin <ul style="list-style-type: none"> • TAF AUC ↓ 55% • TFV AUC ↓ 54% 	If coadministered, monitor for HIV and HBV treatment efficacy.

Table 4. Significant Pharmacokinetic Interactions Between Drugs Used to Treat or Prevent Opportunistic Infections

Primary Drug	Interacting Agent	Effect on Primary and/or Concomitant Drug Concentrations	Recommendations
		<ul style="list-style-type: none"> TFV-DP AUC ↓ 36% Intracellular TFV-DP concentration is 4.2-fold greater than with TDF alone.	Note: FDA labeling recommends not to coadminister.
	TDF	TDF Plus Rifampin 600 mg Daily ↔ TFV	No dosage adjustment necessary
	Voriconazole	Voriconazole AUC ↓ 96%	Do not coadminister. Consider alternative antifungal and/or antimycobacterial agent(s).
Rifapentine ^a	Artemether/Lumefantrine	See Artemether/Lumefantrine.	See Artemether/Lumefantrine.
	Atovaquone	See Atovaquone.	See Atovaquone.
	Bedaquiline	See Bedaquiline.	See Bedaquiline.
	Caspofungin	See Caspofungin.	See Caspofungin.
	Chloroquine	See Chloroquine.	See Chloroquine.
	Clarithromycin	See Clarithromycin.	See Clarithromycin.
	Dapsone	See Dapsone.	See Dapsone.
	Doxycycline	See Doxycycline.	See Doxycycline.
	Erythromycin	See Erythromycin.	See Erythromycin.
	Fluconazole	See Fluconazole.	See Fluconazole.
	Glecaprevir/Pibrentasvir	See Glecaprevir/Pibrentasvir.	See Glecaprevir/Pibrentasvir.
	Ibexafungerp	See Ibexafungerp.	See Ibexafungerp.
	Isavuconazole	See Isavuconazole.	See Isavuconazole.
	Itraconazole	See Itraconazole.	See Itraconazole.
	Linezolid	See Linezolid.	See Linezolid.
	Mefloquine	See Mefloquine.	See Mefloquine.
	Posaconazole	See Posaconazole.	See Posaconazole.
	Quinine	See Quinine.	See Quinine.
	Tedizolid	Daily Rifapentine ↓ tedizolid expected Weekly Rifapentine ↓ tedizolid possible	Daily or Weekly Rifapentine Monitor for tedizolid efficacy.

Table 4. Significant Pharmacokinetic Interactions Between Drugs Used to Treat or Prevent Opportunistic Infections

Primary Drug	Interacting Agent	Effect on Primary and/or Concomitant Drug Concentrations	Recommendations
	TAF	Daily and Weekly Rifapentine ↓ TAF, TFV, TFV-DP possible	If coadministered, monitor for HIV and HBV treatment efficacy. Note: FDA labeling recommends not to coadminister.
	TDF	↔ TDF, TFV, TFV-DP expected	No dosage adjustment necessary
	Sofosbuvir/Velpatasvir	↓ sofosbuvir, velpatasvir expected	Do not coadminister.
	Voriconazole	↓ voriconazole expected	Do not coadminister. Consider alternative antifungal and/or antimycobacterial agent(s).
Sofosbuvir/ Velpatasvir	Rifabutin ^a	See Rifabutin.	See Rifabutin.
	Rifampin ^a	See Rifampin.	See Rifampin.
	Rifapentine ^a	See Rifapentine.	See Rifapentine.
	TAF	TFV AUC ↑ 79% (when RPV/TAF/FTC given with SOF/VEL/VOX) TFV AUC ↑ 67% (when BIC/TAF/FTC given with SOF/VEL/VOX)	No dosage adjustment necessary.
	TDF	TFV AUC ↑ 35% to 40% (when given with EVG/c/FTC or RPV/FTC) TFV AUC ↑ 81% (when given with EFV/FTC and SOF/VEL) TFV AUC ↑ 39% (when given with DRV/r/FTC and SOF/VEL/VOX)	Monitor for TDF toxicities. Consider TAF in place of TDF.
Tedizolid	Rifabutin ^a	See Rifabutin.	See Rifabutin.
	Rifampin ^a	See Rifampin.	See Rifampin.
	Rifapentine ^a	See Rifapentine.	See Rifapentine.
Tenofovir Alafenamide	Glecaprevir/Pibrentasvir	See Glecaprevir/Pibrentasvir.	See Glecaprevir/Pibrentasvir.
	Rifabutin ^a	See Rifabutin.	See Rifabutin.
	Rifampin	See Rifampin.	See Rifampin.
	Rifapentine ^a	See Rifapentine.	See Rifapentine.
	Sofosbuvir/Velpatasvir	See Sofosbuvir/Velpatasvir.	See Sofosbuvir/Velpatasvir.
	Rifabutin ^a	See Rifabutin.	See Rifabutin.

Table 4. Significant Pharmacokinetic Interactions Between Drugs Used to Treat or Prevent Opportunistic Infections

Primary Drug	Interacting Agent	Effect on Primary and/or Concomitant Drug Concentrations	Recommendations
Tenofovir Disoproxil Fumarate	Rifampin ^a	See Rifampin.	See Rifampin.
	Rifapentine ^a	See Rifapentine.	See Rifapentine.
	Glecaprevir/Pibrentasvir	See Glecaprevir/Pibrentasvir.	See Glecaprevir/Pibrentasvir.
	Sofosbuvir/Velpatasvir	See Sofosbuvir/Velpatasvir.	See Sofosbuvir/Velpatasvir.
Voriconazole	Artemether/Lumefantrine	See Artemether/Lumefantrine.	See Artemether/Lumefantrine.
	Bedaquiline	See Bedaquiline.	See Bedaquiline.
	Chloroquine	See Chloroquine.	See Chloroquine.
	Clarithromycin	See Clarithromycin.	See Clarithromycin.
	Erythromycin	See Erythromycin.	See Erythromycin.
	Ibexafungerp	See Ibexafungerp.	See Ibexafungerp.
	Mefloquine	See Mefloquine.	See Mefloquine.
	Quinine	See Quinine.	See Quinine.
	Rifabutin ^a	See Rifabutin.	See Rifabutin.
	Rifampin ^a	See Rifampin.	See Rifampin.
	Rifapentine ^a	See Rifapentine.	See Rifapentine.

^a Refer to the subsection Rifamycin-Related Induction Interactions in the Table 4 introduction above.

Key to Symbols

↑ = increase

↓ = decrease

↔ = less than 20% change in AUC

Key: 14-OH = active metabolite of clarithromycin; AUC = area under the curve; BIC = bictegravir; C_{min} = minimum concentration; C_{ss} = concentration at steady state; DHA = dihydroartemisinin; DRV/r = darunavir/ritonavir; EFV = efavirenz; EVG/c = elvitegravir/cobicistat; FDA = U.S. Food and Drug Administration; FTC = emtricitabine; HBV = hepatitis B virus; RPV = rilpivirine; SOF = sofosbuvir; t_{1/2} = half-life; TAF = tenofovir alafenamide; TDF = tenofovir disoproxil fumarate; TDM = therapeutic drug monitoring; TFV= tenofovir; TFV-DP = tenofovir diphosphate; VEL = velpatasvir; VOX = voxilaprevir

Table 4. Significant Pharmacokinetic Interactions Between Drugs Used to Treat or Prevent Opportunistic Infections

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Table 5. Serious and/or Common Adverse Reactions Associated With Systemically Administered Drugs Used to Treat or Prevent Opportunistic Infections

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Reviewed: March 16, 2026

This table should not be considered a comprehensive list of all possible adverse reactions to each medication. For additional information, clinicians should consult other appropriate resources, such as the U.S. Food and Drug Administration prescribing information. The most serious or common adverse reactions for each drug in the table are generally listed first. For information regarding the effects of these medications on a pregnant woman and the fetus, please refer to the Special Considerations During Pregnancy section of the individual chapter in the guidelines (e.g., see Special Considerations During Pregnancy in the Herpes Simplex Virus chapter for information on the use of acyclovir during pregnancy).

Drug(s)	Adverse Reactions
Acyclovir	<ul style="list-style-type: none"> • Crystalluria and nephrotoxicity secondary to obstructive urolithiasis, particularly after rapid high-dose IV infusion. Risk is increased with dehydration or pre-existing renal impairment. <ul style="list-style-type: none"> ◦ Administer IV fluid hydration to reduce the risk of nephrotoxicity. • Neurotoxicity with high doses (agitation, confusion, hallucination, seizure, coma), especially in people with renal impairment and/or older adults • Thrombophlebitis at peripheral IV infusion site • Nausea, vomiting, and headache
Adefovir	<ul style="list-style-type: none"> • Nephrotoxicity, especially in people with underlying renal insufficiency, predisposing comorbidities, or taking concomitant nephrotoxic drugs • Nausea and asthenia
Albendazole	<ul style="list-style-type: none"> • Rash, pruritus, and fever • Elevated transaminases • Alopecia • Nausea, vomiting, abdominal pain, headache, and dizziness • Bone marrow suppression (i.e., pancytopenia, aplastic anemia, agranulocytosis, and leukopenia) (rare) <ul style="list-style-type: none"> ◦ Individuals with liver disease, including hepatic echinococcosis, appear to be at higher risk.
Amikacin	<ul style="list-style-type: none"> • Nephrotoxicity <ul style="list-style-type: none"> ◦ Administer IV fluid hydration to reduce the risk of nephrotoxicity. • Ototoxicity, both hearing loss and vestibular toxicity, is possible. • Neuromuscular blockade, especially with myasthenia or Parkinson's disease and rapid infusion of large doses (rare)

Table 5. Serious and/or Common Adverse Reactions Associated With Systemically Administered Drugs Used to Treat or Prevent Opportunistic Infections

Drug(s)	Adverse Reactions
Amphotericin B Deoxycholate and Lipid Formulations	<ul style="list-style-type: none"> • Nephrotoxicity (lower incidence with liposomal formulations); irreversible nephrotoxicity is related to cumulative dose. <ul style="list-style-type: none"> ◦ Administer IV fluid hydration to reduce the risk of nephrotoxicity. • Hypokalemia, hypomagnesemia, and hypocalcemia • Infusion-related reactions, including fever, chills, rigors, flank or back pain, and hypotension (lower incidence with liposomal formulations and slower infusion rates) • Thrombophlebitis • Elevated transaminases and bilirubin • Headache, nausea, vomiting, and diarrhea • Heart failure (rarely reported) • Anemia (rare)
Anidulafungin	<ul style="list-style-type: none"> • Refer to Echinocandins below.
Artemether/Lumefantrine	<ul style="list-style-type: none"> • QTc prolongation • Anemia, including delayed hemolytic anemia (rare) • Fever, chills, fatigue, arthralgia, and myalgia • Headache, dizziness, asthenia, and insomnia • Nausea, vomiting, diarrhea, abdominal pain, and anorexia • Rash and pruritus
Artesunate	<ul style="list-style-type: none"> • Acute renal failure requiring dialysis • Hemoglobinuria and jaundice, anemia, thrombocytopenia, neutropenia • Delayed hemolysis and immune hemolytic anemia • QTc prolongation and bradycardia • Hypersensitivity reactions (anaphylaxis) • Dizziness, nausea, and vomiting
Atovaquone	<ul style="list-style-type: none"> • Elevated transaminases • Rash, nausea, vomiting, abdominal pain, and diarrhea • Fever, headache, and insomnia
Atovaquone/Proguanil	<ul style="list-style-type: none"> • Abdominal pain, nausea, vomiting, anorexia, diarrhea, headache, asthenia, dizziness, and rash • Elevated transaminases
Azithromycin	<ul style="list-style-type: none"> • Ototoxicity with prolonged use or high concentrations • Elevated transaminases • Hypersensitivity reactions

Table 5. Serious and/or Common Adverse Reactions Associated With Systemically Administered Drugs Used to Treat or Prevent Opportunistic Infections

Drug(s)	Adverse Reactions
	<ul style="list-style-type: none"> • Nausea, vomiting, metallic taste, diarrhea, and abdominal pain • QTc prolongation
Benznidazole	<ul style="list-style-type: none"> • Photosensitivity and hypersensitivity reactions (including maculopapular rash, allergic dermatitis, TEN, and DRESS) • Paresthesia and peripheral neuropathy, headache, and insomnia • Bone marrow suppression • Nausea, vomiting, abdominal pain, anorexia, and weight loss
Bedaquiline	<ul style="list-style-type: none"> • QTc prolongation • Elevated transaminases • Nausea, vomiting, anorexia, diarrhea, elevated amylase, arthralgia, headache, and skin rash <p>Note: Due to long medication half-life, adverse effects may persist even after discontinuation.</p>
Bezlotoxumab	<ul style="list-style-type: none"> • Exacerbation of congestive heart failure • Nausea, fever, and headache • Infusion-related reactions
Brincidofovir	<ul style="list-style-type: none"> • Elevated transaminases and bilirubin • Nausea, vomiting, and diarrhea • Male infertility
Caspofungin	<ul style="list-style-type: none"> • Refer to Echinocandins below.
Chloroquine and Hydroxychloroquine	<ul style="list-style-type: none"> • Auditory and visual disturbances, including blurry vision. Retinal toxicity may occur with long-term use. • QTc prolongation and cardiac arrhythmias • Cardiomyopathy • Bone marrow suppression and hemolysis • Neuropsychiatric changes, including extrapyramidal reactions, suicidal behavior, and convulsive seizures • Hypersensitivity reactions (including TEN, SJS, and EM) • Severe hypoglycemia which may require adjustment of antidiabetic medications • Photosensitivity, pruritus, skin pigmentation, and exacerbation of psoriasis • Dizziness, headache, nausea, vomiting, diarrhea, anorexia, abdominal pain, and hepatitis • Neuromyopathy (may occur with long-term use) (rare)
Cidofovir	<ul style="list-style-type: none"> • Nephrotoxicity, proteinuria, azotemia, proximal tubular dysfunction (normoglycemic glycosuria, hypophosphatemia), and metabolic acidosis (including Fanconi's syndrome) <ul style="list-style-type: none"> ◦ Administer IV fluid hydration and oral probenecid to reduce the risk for nephrotoxicity.

Table 5. Serious and/or Common Adverse Reactions Associated With Systemically Administered Drugs Used to Treat or Prevent Opportunistic Infections

Drug(s)	Adverse Reactions
	<ul style="list-style-type: none"> • Neutropenia and anemia • Ocular hypotony and anterior uveitis/iritis • Nausea, vomiting, abdominal pain, anorexia, and diarrhea • Asthenia, fever, headache, and alopecia • Side effects most likely related to coadministration with probenecid: rash, nausea, vomiting, anorexia, and gout exacerbation.
Ciprofloxacin	<ul style="list-style-type: none"> • Refer to Fluoroquinolones below.
Clarithromycin	<ul style="list-style-type: none"> • Elevated transaminases and hepatotoxicity (rare) • Ototoxicity, including hearing loss and tinnitus, with high doses or prolonged use • QTc prolongation • Increased risk of cardiac complications or death in people with heart disease • Diarrhea • Headache, nausea, vomiting, diarrhea, abdominal cramps, and dysgeusia
Clindamycin	<ul style="list-style-type: none"> • Diarrhea, including <i>C. difficile</i>–associated diarrhea and pseudomembranous colitis • Metallic taste (with IV infusion), thrombophlebitis, and arrhythmia with rapid IV infusion • Hypersensitivity reactions (including SJS and TEN) • Nausea, vomiting, and abdominal pain • Elevated transaminases
Clotrimazole (Troche)	<ul style="list-style-type: none"> • Nausea, vomiting, anorexia, and metallic taste
Cycloserine	<ul style="list-style-type: none"> • Neuropsychiatric toxicities, including convulsions, psychosis, somnolence, confusion, inability to concentrate, hyperreflexia, headache, tremor, vertigo, paresis, dysarthria, depression (with suicidal ideation), peripheral neuropathy, and seizures (particularly with higher doses and in people with history of chronic alcoholism) <ul style="list-style-type: none"> ◦ Administer with pyridoxine. • Hypersensitivity reactions (including SJS), allergic dermatitis, and rash
Dapsone	<ul style="list-style-type: none"> • Methemoglobinemia, hemolytic anemia, neutropenia, and agranulocytosis <ul style="list-style-type: none"> ◦ Do not use in people with G6PD deficiency. ◦ Risk may be increased with concomitant use of folic acid antagonists (e.g., pyrimethamine). • Rash, fever • Sulfone syndrome (fever, exfoliative dermatitis, lymphadenopathy, hepatic necrosis, and hemolysis) • Phototoxicity and severe cutaneous reactions (including SJS and TEN) • Drug-induced lupus erythematosus

Table 5. Serious and/or Common Adverse Reactions Associated With Systemically Administered Drugs Used to Treat or Prevent Opportunistic Infections

Drug(s)	Adverse Reactions
	<ul style="list-style-type: none"> • Hepatotoxicity and nephrotic syndrome • Peripheral neuropathy • Nausea and anorexia
Doxycycline	<ul style="list-style-type: none"> • Pill-induced esophagitis/esophageal ulceration • Intracranial hypertension • Photosensitivity and skin hyperpigmentation • Thrombophlebitis (with IV infusion) • Nausea and vomiting
Echinocandins (anidulafungin, caspofungin, micafungin)	<ul style="list-style-type: none"> • Histamine-related infusion reactions (flushing, rash, pruritus, hypotension, and dyspnea) and thrombophlebitis • Elevated transaminases and hepatotoxicity • Diarrhea, nausea, vomiting, fever, and headache • Hemolysis (micafungin) (rare)
Emtricitabine	<ul style="list-style-type: none"> • Headache, nausea, and diarrhea • Skin hyperpigmentation and rash (palms and soles)
Entecavir	<ul style="list-style-type: none"> • Headache, fatigue, dizziness, and nausea • Lactic acidosis
Ethambutol	<ul style="list-style-type: none"> • Optic neuritis (dose- and duration-dependent) and peripheral neuropathy • Headache, nausea, vomiting, anorexia, abdominal pain, and hyperuricemia/gout flare • Hypersensitivity reactions
Ethionamide	<ul style="list-style-type: none"> • Dose-dependent GI side effects, including nausea, vomiting, anorexia, diarrhea, abdominal pain, and metallic taste (dose titration may alleviate some symptoms) • Hepatotoxicity • Dizziness, drowsiness, confusion, clumsiness, visual disturbances, depression, peripheral neuropathy, and postural hypotension <ul style="list-style-type: none"> ◦ Administer with pyridoxine. • Photosensitivity and severe cutaneous reactions (including SJS, TEN, and DRESS) • Endocrine side effects, including hypothyroidism (with or without goiter), gynecomastia, acne, alopecia, menstrual irregularities, impotence, and hypoglycemia
Famciclovir	<ul style="list-style-type: none"> • Nephrotoxicity (in people with underlying renal disease) • Headache, nausea, vomiting, and diarrhea
Fidaxomicin	<ul style="list-style-type: none"> • Nausea, vomiting, and abdominal pain

Table 5. Serious and/or Common Adverse Reactions Associated With Systemically Administered Drugs Used to Treat or Prevent Opportunistic Infections

Drug(s)	Adverse Reactions
Flucytosine	<ul style="list-style-type: none"> • Concentration-dependent (>100 mcg/mL) bone marrow suppression (anemia, neutropenia, agranulocytosis, and thrombocytopenia) • Elevated transaminases • Diarrhea, nausea, vomiting, and headache • Rash, pruritus, and photosensitivity
Fluconazole	<ul style="list-style-type: none"> • Hepatotoxicity • QTc prolongation • Alopecia (with doses ≥ 400 mg/day for ≥ 2 months) and dry skin • Nausea, vomiting, diarrhea, and abdominal pain
Fluoroquinolones (ciprofloxacin, levofloxacin, moxifloxacin)	<ul style="list-style-type: none"> • Restlessness, insomnia, nightmares, confusion, anxiety, paranoia, tremors, seizures, hallucinations, depression, suicidal thoughts, and attempted and completed suicide • Tendonitis and tendon rupture (associated with age over 60, concurrent corticosteroids, diabetes, and kidney, heart, and lung transplant) • Diarrhea, including <i>C. difficile</i>–associated diarrhea and colitis • QTc prolongation • Photosensitivity/phototoxicity • Anemia, thrombocytopenia, and leukopenia • Arthralgia and myalgia • Peripheral neuropathy and retinal detachment • Hyper- and hypoglycemia, including hypoglycemic coma • Nausea, diarrhea, bloating, headache, dizziness, and malaise • Vasculitis • Aortic dissection (rare) • Elevated transaminases • Interstitial nephritis (rare) • Severe cutaneous reactions (including SJS and TEN) (rare)
Foscarnet	<ul style="list-style-type: none"> • Nephrotoxicity and electrolyte imbalances (e.g., hypocalcemia, hypomagnesemia, hypophosphatemia, hyperphosphatemia, hypokalemia) <ul style="list-style-type: none"> ◦ Administer IV fluid hydration to reduce the risk of nephrotoxicity. • Paresthesia and seizure (associated with electrolyte imbalances) • Anemia • Nausea, vomiting, anorexia, and headache • Genital ulceration • Thrombophlebitis

Table 5. Serious and/or Common Adverse Reactions Associated With Systemically Administered Drugs Used to Treat or Prevent Opportunistic Infections

Drug(s)	Adverse Reactions
Fumagillin (Investigational)	<ul style="list-style-type: none"> • Nausea, vomiting, diarrhea, anorexia, and abdominal cramps • Thrombocytopenia, anemia, and neutropenia • Vertigo
Ganciclovir	<ul style="list-style-type: none"> • Neutropenia, thrombocytopenia, anemia, and pancytopenia • Nephrotoxicity • Thrombophlebitis • Nausea, vomiting, fever, asthenia, and hyperhidrosis
Glecaprevir/Pibrentasvir	<ul style="list-style-type: none"> • Risk of hepatitis B virus reactivation • Hepatic decompensation/failure in people with advanced liver disease • Mild headache, fatigue, nausea, and diarrhea • Altered glucose tolerance in diabetic patients
Ibrexafungerp	<ul style="list-style-type: none"> • Diarrhea, nausea, abdominal pain, vomiting, and headache
Isavuconazonium Sulfate (Isavuconazole)	<ul style="list-style-type: none"> • Hepatotoxicity and cholelithiasis • Infusion-related reactions (hypotension, dyspnea, chills, dizziness, paresthesia, and hypoesthesia) • Hypersensitivity reactions (including SJS) • Shortening of QT interval • Nausea, vomiting, diarrhea, headache, dyspnea, and cough • Hypokalemia
Isoniazid	<ul style="list-style-type: none"> • Hepatotoxicity or asymptomatic elevation in aminotransferase enzymes • Peripheral neuropathy, paresthesia, seizures, psychosis (rare), and optic neuritis <ul style="list-style-type: none"> ◦ Administering with pyridoxine may prevent or reduce these adverse effects. • Nausea, diarrhea, and flushing • Arthralgia and lupus-like syndrome • Hypersensitivity reactions (including TEN and DRESS) (rare)
Itraconazole	<ul style="list-style-type: none"> • New-onset or worsening heart failure, edema, adrenal insufficiency, and hypokalemia • QTc prolongation • Elevated transaminases and hepatotoxicity
Lamivudine	<ul style="list-style-type: none"> • Nausea and vomiting
Levofloxacin	<ul style="list-style-type: none"> • Refer to Fluoroquinolones above.

Table 5. Serious and/or Common Adverse Reactions Associated With Systemically Administered Drugs Used to Treat or Prevent Opportunistic Infections

Drug(s)	Adverse Reactions
Linezolid	<ul style="list-style-type: none"> • Anemia, neutropenia, and thrombocytopenia (especially with treatment lasting longer than 2–4 weeks, renal insufficiency, or elevated trough concentrations) • Peripheral neuropathy and optic neuritis with long-term therapy • Nausea, vomiting, diarrhea, and headache • Serotonin syndrome (rare) • Seizure (in people with a history of seizure or with risk factors for seizure) (rare) • Lactic acidosis, hypoglycemia, and hyponatremia (rare) • Rhabdomyolysis
Mefloquine	<ul style="list-style-type: none"> • Depression, psychosis, anxiety, agitation, dizziness, headache, insomnia, and abnormal dreams • QTc prolongation and arrhythmias (extrasystole and sinus bradycardia) • Agranulocytosis and aplastic anemia • Nausea, vomiting, diarrhea, and epigastric pain <p>Note: Due to long medication half-life, side effects may persist even after discontinuation.</p>
Micafungin	<ul style="list-style-type: none"> • Refer to Echinocandins above.
Miconazole Buccal Tablets	<ul style="list-style-type: none"> • Dysgeusia, diarrhea, nausea, vomiting, upper abdominal pain, and headache • Local reactions (e.g., oral discomfort, burning, pain, tongue/mouth ulceration, gingival pruritus, swelling, and dry mouth) • Hypersensitivity reactions (may occur in people with known hypersensitivity reaction to milk product concentrate)
Miltefosine	<ul style="list-style-type: none"> • Nephrotoxicity and elevated transaminases and bilirubin • Retinal degeneration • Leukocytosis and thrombocytopenia • Impaired fertility, scrotal pain, and impaired ejaculation • Nausea, vomiting, diarrhea, anorexia, headache, and motion sickness • Severe cutaneous reactions (including SJS)
Moxifloxacin	<ul style="list-style-type: none"> • Refer to Fluoroquinolones above.
Nifurtimox	<ul style="list-style-type: none"> • People with a history of brain injury, seizures, psychiatric disease, and serious behavioral alterations may experience worsening of their conditions. • Vomiting, nausea, decreased appetite, weight loss, abdominal pain, headache, fever, polyneuropathy, insomnia, restlessness, tremors, dizziness, and vertigo • Carcinogenic and teratogenic potential and impaired fertility • Hypersensitivity reactions with hypotension, angioedema, dyspnea, pruritus, rash, or other severe skin reactions

Table 5. Serious and/or Common Adverse Reactions Associated With Systemically Administered Drugs Used to Treat or Prevent Opportunistic Infections

Drug(s)	Adverse Reactions
Nitazoxanide	<ul style="list-style-type: none"> • Nausea, vomiting, diarrhea, abdominal pain, headache, and chromaturia
Nystatin (Oral Preparations)	<ul style="list-style-type: none"> • Unpleasant taste, nausea, vomiting, anorexia, and diarrhea
Omadacycline	<ul style="list-style-type: none"> • Nausea, vomiting, and diarrhea • Elevated transaminases • Infusion site reactions
Oteseconazole	<ul style="list-style-type: none"> • Nausea, diarrhea, and headache
Paromomycin	<ul style="list-style-type: none"> • Nausea, vomiting, abdominal cramps, anorexia, rash, and headache • Nephrotoxicity (rare) <ul style="list-style-type: none"> ◦ Inflammatory bowel disease and renal insufficiency may increase risk.
Penicillin G	<p>All Penicillin G Preparations</p> <ul style="list-style-type: none"> • Hypersensitivity (immediate or delayed reactions, including anaphylaxis), bone marrow suppression, nausea, vomiting, diarrhea, and drug fever • Jarisch-Herxheimer reaction when used for syphilis (occurs most frequently in persons with early syphilis, high non-treponemal antibody titers, and prior penicillin treatment) <p>Benzathine Penicillin G</p> <ul style="list-style-type: none"> • IM injection-site reactions (pain and erythema), procaine neuropsychiatric reactions (with high dose), and neurovascular damage (due to inadvertent intravascular instead of IM injection) <p>Aqueous Crystalline Penicillin G (IV)</p> <ul style="list-style-type: none"> • Thrombophlebitis • Neurotoxicity at high doses—especially in people with renal dysfunction—and hyperkalemia or hypernatremia at high doses (depending on formulation)
Pentamidine	<p>IV Administration</p> <ul style="list-style-type: none"> • Nephrotoxicity, azotemia • Infusion-related hypotension and thrombophlebitis • QTc prolongation, arrhythmias (including Torsades de pointes), and electrolyte abnormalities • Hypoglycemia, hyperglycemia, and diabetes mellitus • Hepatotoxicity and GI intolerance • Leukopenia and thrombocytopenia • Rash • Pancreatitis (rare) <p>Aerosolized Therapy</p> <ul style="list-style-type: none"> • Bronchospasm, cough, dyspnea, tachypnea, and metallic taste

Table 5. Serious and/or Common Adverse Reactions Associated With Systemically Administered Drugs Used to Treat or Prevent Opportunistic Infections

Drug(s)	Adverse Reactions
Posaconazole	<p>IV or PO Administration</p> <ul style="list-style-type: none"> • Hepatotoxicity • QTc prolongation and hypokalemia • Pseudohyperaldosteronism (hypokalemia and hypertension) • Nausea, vomiting, diarrhea, abdominal pain, and headache <p>IV Infusion</p> <ul style="list-style-type: none"> • Thrombophlebitis, SBED accumulation, and worsening renal function with IV formulation (especially in people with eGFR <50 mL/min per package labeling, but observational studies with IV voriconazole suggest that this may not be a concern)
Pretomanid	<p>Adverse Events Reported When Used in Combination With Other Antituberculosis Medications</p> <ul style="list-style-type: none"> • Nausea, vomiting, headache, and diarrhea • Elevated transaminases • Peripheral and optic neuropathy, myelosuppression, and lactic acidosis (with linezolid) • QTc prolongation (with bedaquiline) <p>Other</p> <ul style="list-style-type: none"> • Dose-related increase in serum creatinine without change in GFR
Primaquine	<ul style="list-style-type: none"> • Methemoglobinemia, hemolytic anemia (use with caution in people with mild-moderate G6PD deficiency; do not use if severe G6PD deficiency), leukopenia, and neutropenia • QTc prolongation • Abdominal cramps, nausea, vomiting, and dizziness
Pyrazinamide	<ul style="list-style-type: none"> • Hepatotoxicity • Polyarthralgia and myalgia • Hyperuricemia/gout flare • Thrombocytopenia and sideroblastic anemia • Nausea, vomiting, flushing, rash, and photosensitivity
Pyrimethamine	<ul style="list-style-type: none"> • Neutropenia, anemia, thrombocytopenia, and megaloblastic anemia <ul style="list-style-type: none"> ◦ Administer with leucovorin to reduce the risk of bone marrow suppression. • Anorexia, nausea, vomiting, and rash
Quinine	<ul style="list-style-type: none"> • QTc prolongation and cardiac arrhythmias • Cinchonism (tinnitus, vertigo, and blurred vision) • Hemolytic anemia (especially in patients with G6PD deficiency), thrombocytopenia, and agranulocytosis • Vision abnormalities (e.g., photophobia, altered color perception, and blindness)

Table 5. Serious and/or Common Adverse Reactions Associated With Systemically Administered Drugs Used to Treat or Prevent Opportunistic Infections

Drug(s)	Adverse Reactions
	<ul style="list-style-type: none"> • Hypersensitivity reactions (including SJS and TEN) • Hypoglycemia • Headache, nausea, vomiting, and diarrhea
Rifabutin	<ul style="list-style-type: none"> • Concentration-dependent uveitis, neutropenia, and thrombocytopenia • Arthralgia • Hepatotoxicity • Rash • Nausea, vomiting, abdominal pain, diarrhea, and anorexia • Red-orange discoloration of body fluids (e.g., urine, sweat, saliva)
Rifampin	<ul style="list-style-type: none"> • Hepatotoxicity (cholestatic hepatitis) • Thrombocytopenia and hemolytic anemia • Renal failure • Hypersensitivity reactions with flu-like syndrome • Interstitial pulmonary disease • Nausea, vomiting, anorexia, abdominal pain, flatulence, diarrhea, headache, confusion, flushing, and rash • Red-orange discoloration of body fluids
Rifapentine	<ul style="list-style-type: none"> • Hepatotoxicity • Anemia, neutropenia, and lymphopenia • Hypersensitivity reactions, including flu-like symptoms • Arthralgia • Rash and pruritis • Nausea, vomiting, diarrhea, and anorexia • Red-orange discoloration of body fluids
Sofosbuvir/Velpatasvir	<ul style="list-style-type: none"> • Risk of hepatitis B virus reactivation • Headache, fatigue, and anemia (associated with ribavirin coadministration) • Altered glucose tolerance in diabetic persons
Streptomycin	<ul style="list-style-type: none"> • Neurotoxicity, including irreversible ototoxicity (both hearing loss and vestibular toxicity) • Nephrotoxicity • Neuromuscular blockade and respiratory paralysis (associated with rapid infusion of large aminoglycoside doses)
Sulfadiazine	<ul style="list-style-type: none"> • Severe cutaneous reactions (including SJS, EM, and TEN) and photosensitivity • Anemia, neutropenia, agranulocytosis, and thrombocytopenia

Table 5. Serious and/or Common Adverse Reactions Associated With Systemically Administered Drugs Used to Treat or Prevent Opportunistic Infections

Drug(s)	Adverse Reactions
	<ul style="list-style-type: none"> • Crystalluria (nephrolithiasis, urolithiasis) and nephrotoxicity <ul style="list-style-type: none"> ◦ Administer oral or IV fluid hydration to reduce the risk of nephrotoxicity. • Hepatotoxicity • Drug fever • Peripheral neuritis, tinnitus, hallucinations, seizures (rare), vertigo, and insomnia • Nausea, vomiting, diarrhea, and headache
Tafenoquine	<ul style="list-style-type: none"> • Decreased hemoglobin as a result of methemoglobinemia and hemolytic anemia <ul style="list-style-type: none"> ◦ Do not use in people with G6PD deficiency; may cause harm to fetuses and breastfeeding infants who are G6PD-deficient. • Psychiatric adverse reactions (in people with history of psychiatric illness) • Hypersensitivity reactions (angioedema and urticaria) • Visual disturbances • Dizziness, nausea, vomiting, and headache
Tecovirimat	<p>IV or PO Administration</p> <ul style="list-style-type: none"> • Headache, nausea, abdominal pain, and vomiting <p>IV Infusion</p> <ul style="list-style-type: none"> • Infusion site pain, swelling, erythema, and extravasation • Contains hydroxypropyl-β-cyclodextrin, which may accumulate in people with renal impairment and has the potential to cause renal toxicity
Tedizolid	<ul style="list-style-type: none"> • Nausea, vomiting, and diarrhea • Headache and dizziness • Infusion- or injection-related reactions • Thrombocytopenia
Tenofovir Disoproxil Fumarate	<ul style="list-style-type: none"> • Renal insufficiency and Fanconi syndrome (proximal renal tubulopathy with hypophosphatemia, hypouricemia, proteinuria, and normoglycemic glycosuria) • Decreased bone mineral density • Nausea and vomiting
Tenofovir Alafenamide	<ul style="list-style-type: none"> • Lower incidence of renal or bone toxicities than with tenofovir disoproxil fumarate
Trimethoprim-Sulfamethoxazole	<ul style="list-style-type: none"> • Cutaneous reactions (in some cases SJS, EM, and TEN) and photosensitivity • Anemia, neutropenia, agranulocytosis, and thrombocytopenia • Hepatotoxicity • Dose-dependent increase in serum creatinine (without change in eGFR), interstitial nephritis, crystalluria (in people with inadequate hydration), and hyperkalemia (with high-dose TMP) <ul style="list-style-type: none"> ◦ Encourage oral hydration when using oral TMP-SMX.

Table 5. Serious and/or Common Adverse Reactions Associated With Systemically Administered Drugs Used to Treat or Prevent Opportunistic Infections

Drug(s)	Adverse Reactions
	<ul style="list-style-type: none"> • Hypoglycemia and hyponatremia • Drug fever • Nausea and vomiting • Aseptic meningitis and pancreatitis (rare)
Valacyclovir	<ul style="list-style-type: none"> • Neurotoxicity (e.g., agitation, confusion, hallucination, seizure, coma) with high doses, especially in people with renal impairment • Nephrotoxicity <ul style="list-style-type: none"> ◦ Encourage oral fluid hydration to reduce the risk of nephrotoxicity. • Nausea, vomiting, abdominal pain, and headache
Valganciclovir	<ul style="list-style-type: none"> • Bone marrow suppression • Confusion, fever, and tremor • Nephrotoxicity <ul style="list-style-type: none"> ◦ Encourage oral fluid hydration to reduce the risk of nephrotoxicity. • Carcinogenic and teratogenic potential and impaired fertility • Nausea, vomiting, and diarrhea
Voriconazole	<ul style="list-style-type: none"> • Visual disturbances (e.g., abnormal vision, color vision change, and/or photophobia) • Optic neuritis (associated with >28 days treatment) • Headache, delirium, hallucination, peripheral neuropathy (rare), and encephalopathy (associated with trough >5.5 mcg/mL) • Hepatotoxicity • QTc prolongation • Photosensitivity • Voriconazole-associated cutaneous squamous cell carcinoma (with long-term use) • Fluorosis and periostitis with high dose and/or prolonged use • Fever, nausea, vomiting, chills, tachycardia, and peripheral edema • Nail changes and alopecia (with long-term use) • SBECD accumulation with IV formulation and worsening renal function (especially in people with eGFR <50 mL/min per package labeling, but observational studies suggest that this may not be a concern)

Key: DRESS = drug reaction with eosinophilia and systemic symptoms; eGFR = estimated glomerular filtration rate; EM = erythema multiforme; G6PD = glucose-6-phosphate dehydrogenase; GFR = glomerular filtration rate; GI = gastrointestinal; IM = intramuscular; IV = intravenous; PO = oral; QTc = QT corrected for heart rate; SBECD = sulfobutylether cyclodextrin; SJS = Stevens-Johnson syndrome; TEN = toxic epidermal necrolysis; TMP = trimethoprim; TMP-SMX = trimethoprim-sulfamethoxazole

Table 6. Dosing Recommendations for Drugs Used to Treat or Prevent Opportunistic Infections that Require Dosage Adjustment in Adults With Renal Insufficiency

Updated: April 23, 2025

Reviewed: March 16, 2026

Individuals with reduced renal function are at risk of drug accumulation and concentration-dependent toxicities when taking medications that are primarily excreted by the kidneys. The dosage adjustment recommendations in Table 6 are based on estimates of renal function using either creatinine clearance (CrCl) or estimated glomerular filtration rate (eGFR). Although both methods are commonly used to determine dosage adjustments, it is important to note that CrCl and eGFR are not interchangeable and may yield differing results.

Renal clearance, though critical, is only one of several pharmacokinetic parameters that influence disposition of drugs that are primarily excreted by the kidneys. Other factors, such as alterations in volume of distribution or reduction in oral absorption, can also impact drug concentrations. For instance, although reduced renal clearance may necessitate a dose reduction to prevent drug accumulation, increased volume of distribution or impaired oral absorption might require a dose increase to achieve therapeutic concentrations.

Therapeutic drug monitoring (TDM), if available and appropriate, allows the clinician to make informed, individualized decisions in complicated scenarios, leading to dose adjustments that are more precise than those based on estimated CrCl or eGFR. When TDM is desired, clinicians should contact their clinical laboratory to determine assay availability and turnaround time for their institution. Drugs in this table that are used for the prevention or treatment of opportunistic infections and that are known to have assays (for clinical and/or research purposes) available within the United States and typically in Europe include the following:

- Acyclovir
- Amikacin
- Ciprofloxacin
- Clarithromycin
- Cycloserine
- Emtricitabine
- Ethambutol
- Ethionamide
- Famciclovir
- Fluconazole
- Flucytosine
- Ganciclovir
- Levofloxacin
- Posaconazole
- Pyrazinamide
- Quinine
- Rifabutin
- Tenofovir
- Trimethoprim
- Valacyclovir
- Voriconazole

Note: The dosing recommendations provided for people on hemodialysis (HD) specifically apply to those receiving intermittent HD several times weekly. Guidance for other forms of renal replacement therapy (RRT), such as peritoneal dialysis or continuous RRT, is beyond the scope of these guidelines. Given the complexities of drug dosing in people receiving other forms of RRT, clinicians should consult specialists and consider TDM to ensure optimal management.

Table 6. Dosing Recommendations for Drugs Used to Treat or Prevent Opportunistic Infections That Require Dosage Adjustment in Adults With Renal Insufficiency

Drug(s)	Usual Dose	Dosage Adjustment in Renal Insufficiency	
		CrCl [^] or eGFR [#] (mL/min)	Dose
Acyclovir <i>For IV acyclovir, administer IV fluid hydration to reduce the risk of nephrotoxicity.</i>	IV Dose for Serious HSV Infections <ul style="list-style-type: none"> 5 mg/kg IV every 8 hours IV Dose for Serious VZV Infections or HSV Encephalitis <ul style="list-style-type: none"> 10 mg/kg IV every 8 hours 	26–50	100% of dose IV every 12 hours
		10–25	100% of dose IV every 24 hours
		<10 or HD	50% of dose IV every 24 hours For people on HD, administer dose after HD on dialysis days.
	PO Dose for Herpes Zoster: 800 mg PO five times per day	10–25	800 mg PO every 8 hours
		<10 or HD	800 mg PO every 12 hours For people on HD, administer dose after HD on dialysis days.
Amikacin <i>Administer IV fluid hydration to reduce the risk of nephrotoxicity.</i>	For Mycobacterial Infections: <ul style="list-style-type: none"> 15 mg/kg IV per day Target peak concentration 35–45 mcg/mL; target trough concentration <5 mcg/mL <i>or</i> <ul style="list-style-type: none"> 25 mg/kg IV three times per week Target peak concentration 65–80 mcg/mL; target trough concentration <5 mcg/mL 	<60 or HD Use with caution in people with renal insufficiency and ototoxicity.	Perform TDM to adjust dose and interval as needed to attain target concentrations. Doses likely needed only 2–3 times per week. Consider consulting local pharmacokinetic dosing services if available. For people on HD, administer dose after HD on dialysis days.
Cidofovir <i>Administer IV fluid hydration and oral probenecid to reduce the risk of nephrotoxicity (see Table 2 for dosing instructions).</i>	5 mg/kg IV on Day 0, repeat 5 mg/kg IV dose on Day 7, then 5 mg/kg IV every 2 weeks	Pretreatment SCr >1.5 mg/dL <i>or</i> CrCl ≤55 mL/min <i>or</i> Urine protein ≥100 mg/dL (≥2+ proteinuria)	Cidofovir is not recommended unless benefits outweigh risks. See “Pharmacokinetics of cidofovir in renal insufficiency and in continuous ambulatory peritoneal dialysis or high-flux hemodialysis” for recommendations on renal dose adjustments.

Table 6. Dosing Recommendations for Drugs Used to Treat or Prevent Opportunistic Infections That Require Dosage Adjustment in Adults With Renal Insufficiency

Drug(s)	Usual Dose	Dosage Adjustment in Renal Insufficiency	
		CrCl [^] or eGFR [#] (mL/min)	Dose
		If SCr increases by 0.3–0.4 mg/dL above baseline	Decrease to 3 mg/kg IV per dose.
		If SCr increases by ≥0.5 mg/dL above baseline or ≥3+ proteinuria	Discontinue therapy.
Ciprofloxacin	500–750 mg PO every 12 hours or 400 mg IV every 8–12 hours	30–50	500–750 mg PO every 12 hours or 400 mg IV every 12 hours
		<30	250–500 mg PO every 24 hours or 400 mg IV every 24 hours
		HD	250–500 mg PO every 24 hours or 200–400 mg IV every 24 hours; administer dose after HD on dialysis days.
Clarithromycin	500 mg PO every 12 hours	30–60	Usual dose unless used with an HIV PI or with COBI, then reduce dose by 50% (or consider using azithromycin as alternative).
		<30 or HD	250 mg PO twice daily or 500 mg PO once daily If used with an HIV PI or COBI, reduce dose by 75% (or consider using azithromycin as alternative).

Table 6. Dosing Recommendations for Drugs Used to Treat or Prevent Opportunistic Infections That Require Dosage Adjustment in Adults With Renal Insufficiency

Drug(s)	Usual Dose	Dosage Adjustment in Renal Insufficiency		
		CrCl ^a or eGFR [#] (mL/min)	Dose	
Cycloserine	10–15 mg/kg/day PO in two divided doses (maximum 1,000 mg/day); start at 250 mg once daily and increase dose per tolerability. Target peak concentration 20–35 mcg/mL	30–80	Usual dose; consider TDM and monitor for toxicities.	
		<30 or HD	250 mg once daily or 500 mg three times per week Perform TDM and adjust dose accordingly. Monitor for toxicities. Use with caution in people with ESRD who are not on dialysis.	
Emtricitabine ^a (FTC) Note: Please refer to Appendix B in the Adult and Adolescent Antiretroviral Guidelines for dosing recommendations for ARV FDC products containing FTC.	One 200 mg capsule PO once daily or 240 mg solution PO once daily	CrCl ^a or eGFR [#] (mL/min)	Oral Capsules	Oral Solution
		15–29 (see footnote ^b)	200 mg every 72 hours	80 mg every 24 hours
		<15	200 mg every 96 hours	60 mg every 24 hours
		HD (administer dose after HD on dialysis days)	No dose adjustment necessary.	No dose adjustment necessary.
Emtricitabine/ Tenofovir Alafenamide (FTC/TAF) (FDC Trade Name: Descovy) Note: Please refer to Appendix B in the Adult and Adolescent Antiretroviral Guidelines for dosing recommendations for other ARV FDC products containing FTC/TAF.	One tablet (FTC 200 mg/TAF 25 mg) PO once daily	15–29	Coformulated tablet is not recommended. See footnote ^b for more information.	
		<15	Coformulated tablet is not recommended.	
		HD	One tablet daily; on dialysis days, administer dose after HD.	
Emtricitabine/ Tenofovir		30–49	One tablet PO every 48 hours (monitor for worsening renal function or consider switching to TAF)	

Table 6. Dosing Recommendations for Drugs Used to Treat or Prevent Opportunistic Infections That Require Dosage Adjustment in Adults With Renal Insufficiency

Drug(s)	Usual Dose	Dosage Adjustment in Renal Insufficiency		
		CrCl [^] or eGFR [#] (mL/min)	Dose	
Disoproxil Fumarate (FTC/TDF) (FDC Trade Name: Truvada) Note: Please refer to Appendix B in the Adult and Adolescent Antiretroviral Guidelines for dosing recommendations for other ARV FDC products containing FTC/TDF.	One tablet (FTC 200 mg/TDF 300 mg) PO once daily	<30 or HD	Do not use coformulated tablet. Use formulation for each component drug and adjust dose according to recommendations for the individual drugs.	
Entecavir	Usual Dose: 0.5 mg PO once daily For Treatment of 3TC-Refractory HBV or for Decompensated Liver Disease: 1 mg PO once daily	CrCl [^] or eGFR [#] (mL/min)	Usual Renal Dose Adjustment	3TC-Refractory or Decompensated Liver Disease
		30 to <50	<ul style="list-style-type: none"> 0.25 mg PO once daily, <i>or</i> 0.5 mg PO every 48 hours 	<ul style="list-style-type: none"> 0.5 mg PO once daily, <i>or</i> 1 mg PO every 48 hours
		10 to <30	<ul style="list-style-type: none"> 0.15 mg PO once daily, <i>or</i> 0.5 mg PO every 72 hours 	<ul style="list-style-type: none"> 0.3 mg PO once daily, <i>or</i> 1 mg PO every 72 hours
		<10 or HD (for people on HD, administer dose after HD on dialysis days.)	<ul style="list-style-type: none"> 0.05 mg PO once daily, <i>or</i> 0.5 mg PO once every 7 days 	<ul style="list-style-type: none"> 0.1 mg PO once daily, <i>or</i> 1 mg PO once every 7 days
Ethambutol	For MAI: 15 mg/kg PO daily For MTB: 15–25 mg/kg PO daily (See the Mycobacterium tuberculosis section for additional MTB dosing recommendations.)	<30 or HD	For MAI: 15 mg/kg PO three times weekly For MTB: 15–25 mg/kg PO three times weekly For people on HD, administer dose after HD. Perform TDM to guide optimal dosing.	

Table 6. Dosing Recommendations for Drugs Used to Treat or Prevent Opportunistic Infections That Require Dosage Adjustment in Adults With Renal Insufficiency

Drug(s)	Usual Dose	Dosage Adjustment in Renal Insufficiency	
		CrCl ^a or eGFR [#] (mL/min)	Dose
Ethionamide	15–20 mg/kg PO daily (usually 250–500 mg PO once or twice daily)	<30 or HD	250–500 mg PO once daily Consider TDM.
Famciclovir	For Herpes Zoster: 500 mg PO every 8 hours For HSV: 500 mg PO every 12 hours	40–59	500 mg PO every 12 hours
		20–39	500 mg PO every 24 hours
		<20	250 mg PO every 24 hours
		HD	250 mg PO only on HD days; administer dose after HD.
Fluconazole	200–1,200 mg PO or IV every 24 hours (dose and route of administration depends on type of OI)	≤50	Administer 100% of the indication-specific initial dose, then adjust maintenance doses to 50% of dose every 24 hours.
		HD	Administer 100% of the indication-specific initial dose, then adjust maintenance doses to full dose three times per week after HD.
Flucytosine	25 mg/kg PO every 6 hours TDM is recommended to guide optimal dosing (target peak serum concentration 2 hours after dose: 25–100 mcg/mL). If TDM is not possible, monitor CBC twice weekly.	21–40	25 mg/kg PO every 12 hours
		10–20	25 mg/kg PO every 24 hours
		<10	25 mg/kg PO every 48 hours
		HD	25–50 mg/kg PO every 48–72 hours; administer dose after HD.
Foscarnet <i>Administer IV fluid hydration to reduce the risk of nephrotoxicity.</i>	Induction Therapy for CMV Infection: 180 mg/kg/day IV in two divided doses Maintenance Therapy for CMV Infection or for Treatment of HSV Infections: 90–120 mg/kg IV once daily	Dosage adjustment needed according to calculated CrCl/kg; consult product label for dosing table.	Dosage adjustment needed according to calculated CrCl/kg; consult product label for dosing table.

Table 6. Dosing Recommendations for Drugs Used to Treat or Prevent Opportunistic Infections That Require Dosage Adjustment in Adults With Renal Insufficiency

Drug(s)	Usual Dose	Dosage Adjustment in Renal Insufficiency		
		CrCl ^a or eGFR [#] (mL/min)	Dose	
Ganciclovir	Induction Therapy: 5 mg/kg IV every 12 hours	50–69	2.5 mg/kg IV every 12 hours	
		25–49	2.5 mg/kg IV every 24 hours	
		10–24	1.25 mg/kg IV every 24 hours	
		<10 or HD	1.25 mg/kg IV three times per week For people on HD, administer dose after HD.	
	Maintenance Therapy: 5 mg/kg IV every 24 hours	50–69	2.5 mg/kg IV every 24 hours	
		25–49	1.25 mg/kg IV every 24 hours	
		10–24	0.625 mg/kg IV every 24 hours	
		<10 or HD	0.625 mg/kg IV three times per week. For people on HD, administer dose after HD.	
Lamivudine (3TC) Note: Please refer to Appendix B in the Adult and Adolescent Antiretroviral Guidelines for dosing recommendations for ARV FDC products containing 3TC.	300 mg PO every 24 hours See footnote ^d for more information on alternative dosing.	CrCl ^a or eGFR [#] (mL/min)	Epivir Label ^c	Alternative Dose
		15–29	150 mg PO once, then 100 mg PO every 24 hours	100–150 mg every 24 hours
		5–14	150 mg PO once, then 50 mg PO every 24 hours	100–150 mg every 24 hours
		<5 or HD (for people on HD, administer dose after HD on dialysis days)	50 mg PO once, then 25 mg PO every 24 hours	100–150 mg every 24 hours

Table 6. Dosing Recommendations for Drugs Used to Treat or Prevent Opportunistic Infections That Require Dosage Adjustment in Adults With Renal Insufficiency

Drug(s)	Usual Dose	Dosage Adjustment in Renal Insufficiency		
		CrCl [^] or eGFR [#] (mL/min)	Dose	
Lamivudine/ Tenofovir Disoproxil Fumarate (3TC/TDF) (FDC Trade Name: Cimduo) Note: Please refer to Appendix B in the Adult and Adolescent Antiretroviral Guidelines for dosing recommendations for other ARV FDC products containing 3TC/TDF.	One tablet (3TC 300 mg/TDF 300 mg) PO once daily	<50 or HD	Coformulated tablet is not recommended.	
Levofloxacin	500 mg (low dose) or 750–1,000 mg (high dose) IV or PO daily Dose can be adjusted based on serum concentrations	CrCl [^] or eGFR [#] (mL/min)	Low Dose	High Dose
		20–49	500 mg once, then 250 mg every 24 hours, IV or PO	750 mg every 48 hours IV or PO
		<20 or HD (for people on HD, administer dose after HD on dialysis days)	500 mg once, then 250 mg every 48 hours, IV or PO	750 mg once, then 500 mg every 48 hours, IV or PO
Paromomycin	500 mg PO every 6 hours	<10 or HD	Minimal systemic absorption. No dosage adjustment necessary but monitor for worsening renal function and ototoxicity in people with ESRD.	
Penicillin G (Potassium or Sodium)	Neurosyphilis, Ocular Syphilis, or Ootosyphilis • 3–4 million units IV every 4 hours, or • 18–24 million units IV daily as continuous infusion	10–50	2–3 million units IV every 4 hours or 12–18 million units IV as continuous infusion	
		<10	2 million units IV every 4–6 hours or 8–12 million units IV as continuous infusion	
		HD	2 million units IV every 4–6 hours or 8 million units IV as continuous infusion	
Pentamidine	4 mg/kg IV every 24 hours May reduce dose to 3 mg/kg IV daily in the event of toxicities.	<10 or HD	4 mg/kg IV every 48 hours	

Table 6. Dosing Recommendations for Drugs Used to Treat or Prevent Opportunistic Infections That Require Dosage Adjustment in Adults With Renal Insufficiency

Drug(s)	Usual Dose	Dosage Adjustment in Renal Insufficiency	
		CrCl ^a or eGFR [#] (mL/min)	Dose
Posaconazole	IV: 300 mg twice daily on Day 1; then 300 mg once daily Delayed-Release Tablet: 300 mg (three 100 mg delayed-release tablets) PO once daily Oral Suspension: 400 mg PO twice daily	<50 or HD	The manufacturer recommends that IV posaconazole be avoided because of potential toxicity due to accumulation of SBECD (vehicle of IV product), unless benefits outweigh risks. An observational study did not find worsening in renal function in people with CrCl <50 mL/min given SBECD. Switch people with CrCl <50 mL/min to oral posaconazole when feasible. No dosage adjustment of oral dose in people with renal insufficiency. Higher variability in serum concentrations observed in people with CrCl <20 mL/min. Perform posaconazole TDM (target trough concentration >1.25 mcg/mL for treatment).
Pyrazinamide	See the Mycobacterium tuberculosis section for weight-based dosing guidelines.	<30 or HD	25–35 mg/kg/dose three times per week For people on HD, administer dose after HD. Perform TDM to guide optimal dosing.
Quinine Sulfate	650 mg salt (524 mg base) PO every 8 hours	<10 or HD	650 mg once, then 325 mg PO every 12 hours
Rifabutin	5 mg/kg PO daily (usually 300 mg PO daily) See the Mycobacterium tuberculosis section and Drug–Drug Interactions in the Adult and Adolescent Antiretroviral Guidelines for dosage adjustment based on interactions with ARVs.	<30	Perform rifabutin TDM. If rifabutin-associated neutropenia is suspected, consider 50% of dose once daily.
Streptomycin	15 mg/kg IM or IV every 24 hours or 25 mg/kg IM or IV three times per week	Use with caution in people with renal insufficiency.	TDM is no longer available. Consider an alternative aminoglycoside, as clinically appropriate. If used: 15 mg/kg two to three times weekly. Administer dose after HD.
Sulfadiazine <i>Administer oral or IV fluid hydration to reduce the risk for nephrotoxicity.</i>	1,000–1,500 mg PO every 6 hours (1,500 mg every 6 hours for people >60 kg)	≤50 or HD	No data. Use alternative anti-toxoplasma therapy.

Table 6. Dosing Recommendations for Drugs Used to Treat or Prevent Opportunistic Infections That Require Dosage Adjustment in Adults With Renal Insufficiency

Drug(s)	Usual Dose	Dosage Adjustment in Renal Insufficiency	
		CrCl ^a or eGFR [#] (mL/min)	Dose
Tecovirimat	IV 35 to <120 kg • 200 mg every 12 hours ≥120 kg • 300 mg every 12 hours	30–89	No dosage adjustment necessary. Use with caution because of potential accumulation of hydroxypropyl-β-cyclodextrin.
		<30	Contraindicated because of potential accumulation of hydroxypropyl-β-cyclodextrin. Note: IV formulation may be considered in people with CrCl <30 only if drug absorption via enteral administration is expected to be problematic based on an individual risk–benefit assessment in consultation with CDC. In these circumstances, use with caution and monitor renal function continuously. Switch to the oral formulation as soon as possible.
	PO 40 to <120 kg • 600 mg every 12 hours ≥120 kg • 600 mg every 8 hours	Any eGFR	No dosage adjustment necessary.
Tenofovir Alafenamide (TAF) Note: Please refer to Appendix B in the Adult and Adolescent Antiretroviral Guidelines for dosing recommendations for ARV FDC products containing TAF.	25 mg PO daily	<15	Not recommended
		HD	No dosage adjustment necessary. Administer dose after HD on dialysis days.

Table 6. Dosing Recommendations for Drugs Used to Treat or Prevent Opportunistic Infections That Require Dosage Adjustment in Adults With Renal Insufficiency

Drug(s)	Usual Dose	Dosage Adjustment in Renal Insufficiency	
		CrCl [^] or eGFR [#] (mL/min)	Dose
Tenofovir Disoproxil Fumarate (TDF) Note: Please refer to Appendix B in the Adult and Adolescent Antiretroviral Guidelines for dosing recommendations for ARV FDC products containing TDF.	300 mg PO daily	30–49	300 mg PO every 48 hours (consider switching to TAF for treatment of HBV)
		10–29	300 mg PO every 72–96 hours (consider switching to alternative agent for treatment of HBV)
		<10	Not recommended
		HD	300 mg PO once weekly; administer dose after dialysis.
Trimethoprim/Sulfamethoxazole (TMP-SMX) <i>Encourage oral hydration when using oral TMP-SMX.</i>	For PCP Treatment: <ul style="list-style-type: none"> 5 mg/kg (of TMP component) IV every 6–8 hours, or Two TMP-SMX DS tablets PO every 8 hours 	15–30	5 mg/kg (TMP) IV every 12 hours, or two TMP-SMX DS tablets PO every 12 hours
		<15	5 mg/kg (TMP) IV every 24 hours, or one TMP-SMX DS tablet PO every 12 hours (or two TMP-SMX DS tablets every 24 hours)
		HD	5 mg/kg (TMP) IV every 24 hours, or two TMP-SMX DS tablets PO daily; on dialysis days, administer dose after HD. Consider TDM to optimize therapy (target TMP concentrations: 5–8 mcg/mL).
	For PCP Prophylaxis: <ul style="list-style-type: none"> One TMP-SMX DS tablet PO daily, or One TMP-SMX DS tablet PO three times per week, or One TMP-SMX SS tablet PO daily 	15–30	Reduce dose by 50% (e.g., 1 SS tablet PO daily).
		<15 or HD	Reduce dose by 50% or use alternative agent. For people on HD, administer dose after HD on dialysis days.
	For TE Treatment: 5 mg/kg (TMP component) IV or PO every 12 hours	15–30	5 mg/kg (TMP component) IV or PO every 24 hours
		<15 or HD	5 mg/kg (TMP component) IV or PO every 24 hours or use alternative agent. For people on HD, administer dose after HD on dialysis days).
	For TE Chronic Maintenance Therapy: <ul style="list-style-type: none"> One TMP-SMX DS tablet twice daily, or One TMP-SMX DS tablet daily 	15–30	Reduce dose by 50%.
		<15 or HD	Reduce dose by 50% or use alternative agent. For people on HD, administer dose after HD on dialysis days).

Table 6. Dosing Recommendations for Drugs Used to Treat or Prevent Opportunistic Infections That Require Dosage Adjustment in Adults With Renal Insufficiency

Drug(s)	Usual Dose	Dosage Adjustment in Renal Insufficiency		
		CrCl ^a or eGFR [#] (mL/min)	Dose	
	For Toxoplasmosis Primary Prophylaxis: One TMP-SMX DS tablet PO daily	15–30	Reduce dose by 50%.	
		<15 or HD	Reduce dose by 50% or use alternative agent. For people on HD, administer dose after HD on dialysis days.	
Valacyclovir <i>Encourage oral fluid hydration to reduce the risk for nephrotoxicity.</i>	For Herpes Zoster: 1 g PO three times daily	30–49	1 g PO every 12 hours	
		10–29	1 g PO every 24 hours	
		<10 or HD	500 mg PO every 24 hours For people on HD, administer dose after HD on dialysis days).	
	For HSV Treatment: 1 g PO twice daily For HSV Chronic Suppressive Therapy: 500 mg PO twice daily	30–49	No dosage adjustment necessary.	
		10–29	For Treatment: 1 g PO every 24 hours For Suppressive Therapy: 500 mg PO every 24 hours	
		<10 or HD	500 mg PO every 24 hours For people on HD, administer dose after HD on dialysis days).	
Valganciclovir <i>Encourage oral fluid hydration to reduce the risk for nephrotoxicity.</i>	Induction Therapy: 900 mg PO twice daily	CrCl ^a or eGFR [#] (mL/min)	Induction	Maintenance
	Maintenance Therapy: 900 mg PO once daily	40–59	450 mg PO twice daily	450 mg PO daily
		26–39	450 mg PO daily	450 mg PO every 48 hours
		10–25	450 mg PO every 48 hours	450 mg PO twice weekly

Table 6. Dosing Recommendations for Drugs Used to Treat or Prevent Opportunistic Infections That Require Dosage Adjustment in Adults With Renal Insufficiency

Drug(s)	Usual Dose	Dosage Adjustment in Renal Insufficiency		
		CrCl ^a or eGFR [#] (mL/min)	Dose	
		<10 or HD (for people on HD, administer dose after HD on dialysis days)	<p>Not recommended</p> <p>Use IV ganciclovir.</p> <p>May consider:</p> <ul style="list-style-type: none"> • 200 mg (oral powder for solution) PO three times per week <p>If oral powder formulation is not available, consider:</p> <ul style="list-style-type: none"> • 450 mg (tablet) PO three times weekly 	<p>Not recommended</p> <p>Use IV ganciclovir.</p> <p>May consider:</p> <ul style="list-style-type: none"> • 100 mg (oral powder for solution) PO three times per week <p>If oral powder formulation is not available, consider:</p> <ul style="list-style-type: none"> • 450 mg (tablet) PO twice weekly
Voriconazole	<p>6 mg/kg IV every 12 hours for two doses, then 4 mg/kg IV every 12 hours</p> <p>or</p> <p>200–300 mg PO every 12 hours</p>	<50 or HD	<p>IV voriconazole is not recommended by the manufacturer for CrCl <50 mL/min because of potential toxicity from accumulation of SBECD (vehicle of IV product). Observational studies did not find worsening in renal function in people with CrCl <50 mL/min.</p> <p>Switch people with CrCl <50 mL/min or on HD to oral voriconazole when feasible. No need for dosage adjustment when the oral dose is used.</p> <p>Perform TDM to adjust dose.</p>	

^a The prescribing information for emtricitabine (Emtriva) recommends adjusting doses for people with CrCl 30–49 mL/min and for people on hemodialysis. However, the prescribing information for certain FDC products that contain emtricitabine (including Descovy, Biktarvy, Genvoya, and Odefsey) recommends that the standard dose (emtricitabine 200 mg) can be given once daily in these individuals (for people on HD, administer dose after HD on dialysis days). The recommendations in this table incorporate the dosing guidance from the FDC products.

^b To allow people to remain on certain TAF-containing FDC products, some clinicians may use full-dose, daily emtricitabine in people with CrCl 15–29 mL/min who are not on HD. For more information, see the [Adult and Adolescent Antiretroviral Guidelines](#).

^c The prescribing information for lamivudine (Epivir) recommends dosage adjustment from 300 mg once daily to 150 mg once daily for people with CrCl 30–49 mL/min. However, the prescribing information for certain FDC products that contain lamivudine (including Dovato and Triumeq) recommends no dose adjustment for CrCl 30–49 mL/min. The recommendations in this table incorporate the dosing guidance from the FDC products.

^d Clinicians may consider using the nearest available lamivudine tablet strength (100 mg or 150 mg) to avoid the need for 3TC oral solution, thereby simplifying regimens and facilitating adherence. Some clinicians may use full-dose 3TC to allow people to remain on certain FDC antiretroviral products. For more information, see the [Adult and Adolescent Antiretroviral Guidelines](#).

[^] CrCl based on the Cockcroft-Gault formula can be determined using [this CrCl calculator](#). Please refer to the drug's prescribing information and to the National Institute of Diabetes and Digestive and Kidney Diseases [Determining Drug Dosing in Adults with Chronic Kidney Disease](#) page for a discussion on using CrCl based on the Cockcroft-Gault equation versus eGFR.

Table 6. Dosing Recommendations for Drugs Used to Treat or Prevent Opportunistic Infections That Require Dosage Adjustment in Adults With Renal Insufficiency

eGFR based on the 2021 CKD-EPI equation can be determined using this [eGFR calculator](#). Please refer to the drug's prescribing information and to the National Institute of Diabetes and Digestive and Kidney Diseases [Determining Drug Dosing in Adults With Chronic Kidney Disease](#) page for a discussion on using CrCl based on the Cockcroft-Gault equation versus eGFR.

Key: 3TC = lamivudine; ARV = antiretroviral; CBC = complete blood count; CDC = Centers for Disease Control and Prevention; CMV = cytomegalovirus; COBI = cobicistat; CrCl = creatinine clearance; DS = double strength; eGFR = estimated glomerular filtration rate; ESRD = end-stage renal disease; FDC = fixed-dose combination; FTC = emtricitabine; HBV = hepatitis B virus; HD = hemodialysis; HSV = herpes simplex virus; IM = intramuscular; IV = intravenous; MAI = *Mycobacterium avium intracellulare*; MTB = *Mycobacterium tuberculosis*; OI = opportunistic infection; PCP = *Pneumocystis pneumonia*; PI = protease inhibitor; PO = orally; SCr = serum creatinine; SBECd = sulfobutylether cyclodextrin; SS = single strength; TAF = tenofovir alafenamide; TDF = tenofovir disoproxil fumarate; TDM = therapeutic drug monitoring; TE = *Toxoplasma gondii* encephalitis; TMP-SMX = trimethoprim-sulfamethoxazole; VZV = varicella zoster virus