



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

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## Appendix A. Recommendations to Help HIV-infected Patients Avoid Exposure to, or Infection from, Opportunistic Pathogens (Last updated May 7, 2013; last reviewed May 7, 2013)

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### Sexual Exposures

Male latex condoms, when used consistently and correctly during every act of sexual intercourse, are highly effective in preventing the sexual transmission of HIV and can reduce the risk for acquiring other sexually transmitted diseases (STDs), including chlamydia, gonorrhea, and trichomoniasis (<http://www.cdc.gov/condomeffectiveness/latex.htm>). Correct and consistent use of male latex condoms not only reduces the risk of HIV transmission but might reduce the risk for transmission of herpes simplex virus, syphilis, and chancroid when the infected area or potential site of exposure is covered, although data for this effect are more limited.<sup>1,2</sup> Male condoms also appear to reduce the risk for human papillomavirus associated diseases (i.e., genital warts, cervical cancer) and thereby mitigate the adverse consequences of infection with HPV. Although data for female condoms are limited, women should consider using them to prevent the acquisition of STDs and reduce their risk of transmitting HIV.<sup>3</sup> Spermicides containing nonoxynol-9 are not effective for HIV/STD prevention<sup>4-6</sup> and may increase risk of transmission to uninfected partners;<sup>7,8</sup> nonoxynol-9 **should not be used** as a microbicide or lubricant during vaginal or anal intercourse.

As with many non-sexually transmitted opportunistic infections, intercurrent infections with sexually transmitted pathogens (especially pathogens that cause genital ulcers such as herpes simplex, syphilis, and chancroid) can, if untreated, stimulate increases in HIV viral load and consequent declines in CD4 T lymphocyte (CD4) count.<sup>9</sup> Furthermore, acquisition of STDs by HIV-infected patients indicates participation in high-risk sexual behavior that is capable of transmitting HIV to others, the risk for which is substantially increased in the presence of genital tract inflammation (e.g., from gonorrhea or chlamydia) and genital ulcer disease (e.g., herpes simplex virus-2 infection, syphilis).<sup>9-14</sup> All HIV-infected persons, including those who are asymptomatic, should be tested at initial evaluation for trichomoniasis in women; syphilis, urogenital gonorrhea, and chlamydia in men and women; and oral gonorrhea, rectal gonorrhea, and rectal chlamydia for male patients reporting receptive sex at these anatomic sites.<sup>15-17</sup> Nucleic acid amplification testing methods are the most sensitive and specific method for the diagnosis of anogenital, oral, and rectal chlamydia and gonorrhea infection. Detailed recommendations for specific testing in HIV-infected persons can be found at the following site: <http://www.cdc.gov/std/treatment>. For all sexually active patients, screening should be repeated at least annually and more frequently depending on individual risk or symptoms. In addition to identifying and treating STDs, providers should communicate prevention messages, discuss sexual and drug-use behaviors, positively reinforce safer behaviors, refer patients for services such as substance abuse treatment, and facilitate partner notification, counseling, and testing.

Specific sex practices should be avoided that might result in oral exposure to feces (e.g., oral-anal contact) to reduce the risk for intestinal infections (e.g., cryptosporidiosis, shigellosis, campylobacteriosis, amebiasis, giardiasis, lymphogranuloma venereum [LGV] serovars of *C. trachomatis*, hepatitis A [HAV]). Persons who wish to reduce their risk for exposure might consider using dental dams or similar barrier methods for oral-anal and oral-genital contact, changing condoms after anal intercourse, and wearing latex gloves during digital-anal contact. Frequent washing of hands and genitals with warm soapy water during and after activities that might bring these body parts in contact with feces might further reduce risk for illness.

Sexual transmission of hepatitis C virus (HCV) and infection can occur, especially among HIV-infected men who have sex with men (MSM).<sup>18-20</sup> HIV-infected MSM not known to be infected with HCV, and who present with new and unexplained increases in alanine aminotransferase, should be tested for HCV virus infection. Routine (e.g., annual) HCV testing should be considered for MSM with high risk sexual behaviors or with a diagnosis of an ulcerative STD.<sup>16</sup>

HAV can be transmitted sexually, therefore vaccination is recommended for all susceptible MSM, as well as

others with indications for HAV vaccination (e.g., injection-drug users, persons with chronic liver disease or who are infected with hepatitis B [HBV]). HAV vaccination is also recommended for other HIV-infected persons (e.g., injection-drug users, persons with chronic liver disease or who are infected with HBV or HCV). HBV vaccination is recommended for all susceptible HIV-infected patients. HBV infection can occur when mucous membranes are exposed to blood or body fluids that contain blood, which might occur during some types of sexual contact. HIV-infected patients coinfecting with HBV or HCV should be reminded that use of latex condoms not only reduces their risk of transmitting HIV to sexual partners but reduces their risk of transmitting these viral hepatitis infections as well.

## **Injection-Drug-Use Exposures**

Injection-drug use is a complex behavior that puts HIV-infected persons at risk for HBV and HCV infection, additional possibly drug-resistant strains of HIV, and other bloodborne pathogens. Providers should assess a person's readiness to change this practice and encourage activities to provide education and support directed at recovery. Patients should be counseled to stop using injection drugs and to enter and complete substance abuse treatment, including relapse prevention programs.<sup>21</sup>

For patients who continue to inject drugs, health-care providers should advise them to adhere to the following practices:

- Never reuse or share syringes, needles, water, or drug-preparation equipment; if injection equipment that has been used by other persons is shared, the implements should first be cleaned with bleach and water before use.
- Use only sterile syringes and needles obtained from a reliable source (e.g., pharmacies or syringe-exchange programs).
- Use sterile (e.g., boiled) water to prepare drugs, and if this is not feasible, use clean water from a reliable source (e.g., fresh tap water); use a new or disinfected container (i.e., cooker) and a new filter (i.e., cotton) to prepare drugs.
- Clean the injection site with a new alcohol swab before injection.
- Safely dispose of syringes and needles after one use.

All susceptible injection-drug-users should be vaccinated against HBV and HAV infection. HIV-infected injection drug users not known to be HCV infected who present with new and unexplained increases in alanine aminotransferase should be tested for HCV infection. Routine (e.g., annual) HCV testing should be considered for injection drug users who continue to inject drugs.

## **Environmental and Occupational Exposures**

Certain activities or types of employment might increase the risk for exposure to tuberculosis (TB). These include residency or occupation in correctional institutions and shelters for the homeless, other settings identified as high risk by local health authorities, as well as volunteer work or employment in health-care facilities where patients with TB are treated. Decisions regarding the risk of occupational exposure to TB should be made in conjunction with a health-care provider and should be based on such factors as the patient's specific duties in the workplace, the prevalence of TB in the community, and the degree to which precautions designed to prevent the transmission of TB are taken in the workplace. These decisions will affect the frequency with which the patient should be screened for TB.

Day care providers and parents of children in child care are at increased risk for acquiring cytomegalovirus infection, cryptosporidiosis, and other infections (e.g., HAV, giardiasis) from children. The risk for acquiring infection can be diminished by practicing optimal hygienic practices (e.g., washing hands with soap and water, or alcohol-based hand sanitizers if soap and water are unavailable) after fecal contact (e.g., during

diaper changing) and after contact with urine or saliva.

Occupations involving contact with animals (e.g., veterinary work and employment in pet stores, farms, or slaughterhouses) might pose a risk for toxoplasmosis, cryptosporidiosis, salmonellosis, campylobacteriosis, *Bartonella* infection, *E. coli* infection, and other infections of concern to any immunocompromised host (e.g., leptospirosis, brucellosis, *Capnocytophaga spp.*). However, available data are insufficient to justify a recommendation against HIV-infected persons working in such settings. Wearing gloves and good hand hygiene can reduce the risk of infection.

Contact with young farm animals, specifically animals with diarrhea, should be avoided to reduce the risk for cryptosporidiosis. Since soils and sands can be contaminated with *Toxoplasma gondii* and *Cryptosporidium parvum*, persons who have extended contact with these materials (e.g., gardening; playing in or cleaning sandboxes) should wash their hands thoroughly with soap and water following exposure. In areas where histoplasmosis is endemic, patients should avoid activities known to be associated with increased risk (e.g., creating dust when working with surface soil; cleaning chicken coops that are heavily contaminated with compost droppings; disturbing soil beneath bird-roosting sites; cleaning, remodeling or demolishing old buildings; and cave exploring). In areas where coccidioidomycosis is endemic, when possible, patients should avoid activities associated with increased risk, including extensive exposure to disturbed native soil (e.g., building excavation sites, during dust storms).

## Pet-Related Exposures

Health-care providers should advise HIV-infected persons of the potential risk posed by pet ownership. However, they should be sensitive to the psychological benefits of pet ownership and should **not** routinely advise HIV-infected persons to part with their pets. Specifically, providers should advise HIV-infected patients of the following precautions.

### General

HIV-infected persons should avoid direct contact with stool from pets or stray animals. Veterinary care should be sought when a pet develops diarrheal illness. If possible, HIV-infected persons should avoid contact with animals that have diarrhea.

When obtaining a new pet, HIV-infected patients should avoid animals aged <6 months (or <1 year for cats) and specifically animals with diarrhea. Because the hygienic and sanitary conditions in pet-breeding facilities, pet stores, and animal shelters vary, patients should be cautious when obtaining pets from these sources. Stray animals should also be avoided, and specifically those with diarrhea.

Gloves should always be worn when handling feces or cleaning areas that might have been contaminated by feces from pets. Patients should wash their hands after handling pets and also before eating. Patients, especially those with CD4 cell counts < 200 cells/ $\mu$ L should avoid direct contact with all animal feces to reduce the risk for toxoplasmosis, cryptosporidiosis, salmonellosis, campylobacteriosis, *E. coli* infection, and other infectious illnesses. HIV-infected persons should limit or avoid direct exposure to calves and lambs (e.g., farms, petting zoos). Paying attention to hand hygiene (i.e., washing hands with soap and water, or alcohol-based hand sanitizers if soap and water are unavailable) and avoiding direct contact with stool are important when visiting premises where these animals are housed or exhibited.

Patients should not allow pets, particularly cats, to lick patients' open cuts or wounds and should take care to avoid any animal bites. Patients should wash all animal bites, animal scratches, or wounds licked by animals promptly with soap and water and seek medical attention. A course of antimicrobial therapy might be recommended if the wounds are moderate or severe, demonstrate crush injury and edema, involve the bones of a joint, involve a puncture of the skin near a joint, or involve a puncture of a joint directly.

## **Cats**

Patients should be aware that cat ownership may under some circumstances increase their risk for toxoplasmosis and *Bartonella* infection, and enteric infections. Patients who elect to obtain a cat should adopt or purchase an animal aged >1 year and in good health to reduce the risk for cryptosporidiosis, *Bartonella* infection, salmonellosis, campylobacteriosis, and *E. coli* infection.

Litter boxes should be cleaned daily, preferably by an HIV-negative, non-pregnant person; if HIV-infected patients perform this task, they should wear gloves and wash their hands thoroughly afterward to reduce the risk for toxoplasmosis. To further reduce the risk for toxoplasmosis, HIV-infected patients should keep cats indoors, not allow them to hunt, and not feed them raw or undercooked meat. Although declawing is not usually advised, patients should avoid activities that might result in cat scratches or bites to reduce the risk for *Bartonella* infection. Patients should also wash sites of cat scratches or bites promptly and should not allow cats to lick patients' open cuts or wounds. Care of cats should include flea control to reduce the risk for *Bartonella* infection. Testing cats for toxoplasmosis or *Bartonella* infection **is not recommended**, as such tests cannot accurately identify animals that pose a current risk for human infection.

## **Birds**

Screening healthy birds for *Cryptococcus neoformans*, *Mycobacterium avium*, or *Histoplasma capsulatum* **is not recommended**.

## **Other**

HIV-infected persons should avoid or limit contact with reptiles (e.g., snakes, lizards, iguanas, and turtles) and chicks and ducklings because of the high risk for exposure to *Salmonella spp.* Gloves should be used during aquarium cleaning to reduce the risk for infection with *Mycobacterium marinum*. Contact with exotic pets (e.g., nonhuman primates) should be avoided.

## **Food- and Water-Related Exposures**

### **Food**

Contaminated food is a common source of enteric infections. Transmission most often occurs by ingestion of undercooked foods or by cross-contamination of foods in the kitchen.

Health-care providers should advise HIV-infected persons, particularly those with a CD4 count <200 cells/ $\mu$ L, not to eat raw or undercooked eggs, including specific foods that might contain raw eggs (e.g., certain preparation of Hollandaise sauce, Caesar salad dressings, homemade mayonnaises, uncooked cookie and cake batter, eggnog); raw or undercooked poultry, meat, and seafood (raw shellfish in particular); unpasteurized dairy products (including milk and cheese); unpasteurized fruit juices; and raw seed sprouts (e.g., alfalfa sprouts or mung bean sprouts).

Meat and poultry are safest when adequate cooking is confirmed by thermometer. Current U.S. Department of Agriculture (USDA) guidance ([http://www.fsis.usda.gov/Factsheets/Keep\\_Food\\_Safe\\_Food\\_Safety\\_Basics/index.asp](http://www.fsis.usda.gov/Factsheets/Keep_Food_Safe_Food_Safety_Basics/index.asp)) is that the internal temperature be at least 145°F (63°C) for whole cuts of meat, 160°F (71°C) for ground meat excluding poultry, and 165°F (74°C) for poultry; whole cuts of meat and poultry should rest at least three minutes before carving and consuming. Immunocompromised persons who wish to maximally ensure their cooked meats are safe to eat may choose to use the following recommendations: the internal temperature should be at least 165°F (74°C) for all types of red meats and 180°F (82°C) for poultry. If a thermometer is not used when cooking meats, the risk for illness is decreased by eating poultry and meat that have no trace of pink color. However, color change of the meat (e.g., absence of pink) does not always correlate with internal temperature. Irradiated meats, if available, are predicted to eliminate the risk of foodborne enteric infection. Use of microwaves as a primary means of cooking of potentially contaminated foods (e.g., meats, hot dogs) should be avoided because microwave cooking is not uniform.

Produce items should be washed thoroughly; providers may wish to advise patients that produce is safest when cooked.

Health-care providers should advise HIV-infected persons to avoid cross-contamination of foods. Salad preparation prior to handling of raw meats or other uncooked, potentially contaminated foods decreases risk. Uncooked meats, including hot dogs, and their juices should not come into contact with other foods. Hands, cutting boards, counters, knives, and other utensils should be washed thoroughly (preferably in a dish washer on hot cycle) after contact with uncooked foods.

Soft cheeses (e.g., feta, Brie, Camembert, blue-veined, and Mexican-style cheese such as queso fresco) and prepared deli foods (including coldcuts, salads, hummus, hot dogs, pâtés) are potential sources of *Listeria monocytogenes* infection, which can lead to serious, even fatal, systemic infection in HIV-infected patients with low CD4 cell counts; consumption of these foods should be avoided.

Hard cheeses, processed cheeses, cream cheese, including slices and spreads; cottage cheese or yogurt; and canned or shelf-stable pâté and meat spreads need not be avoided. Avoid raw or unpasteurized milk, including goat's milk, or foods that contain unpasteurized milk or milk products.

Additional and more detailed information on the safe handling and preparation of food for persons with HIV infection can be found through the websites of the Food and Drug Administration (<http://www.fda.gov/ForConsumers/ByAudience/ForPatientAdvocates/HIVandAIDSActivities/ucm135844.htm>) and the USDA ([http://www.fsis.usda.gov/pdf/food\\_safety\\_for\\_people\\_with\\_hiv.pdf](http://www.fsis.usda.gov/pdf/food_safety_for_people_with_hiv.pdf)).

## ***Water***

Patients should **not** drink water directly from lakes or rivers because of the risk for cryptosporidiosis, giardiasis, and toxoplasmosis. Waterborne infection can also result from swallowing water during recreational activities. All HIV-infected patients should avoid swimming in water that is probably contaminated with human or animal waste and should avoid swallowing water during swimming. Patients, especially those with CD4 cell counts <200 cells/ $\mu$ L, should also be made aware that swimming or playing in lakes, rivers, and oceans as well as some swimming pools, recreational water parks, and ornamental water fountains can expose them to enteric pathogens (e.g., *Cryptosporidium*, *Giardia*, norovirus, Shiga toxin-producing *E. coli*) that cause diarrheal illness and to which their HIV infection makes them more susceptible.

Outbreaks of diarrheal illness have been linked to drinking water from municipal water supplies. During outbreaks or in other situations in which a community boil-water advisory is issued, boiling water for >1 minute will eliminate the risk for most viral, bacterial, and parasitic causes of diarrhea, including cryptosporidiosis. Using submicron, personal-use water filters (home/office types) or drinking bottled water might also reduce the risk from municipal and from well water.

Available data are inadequate to support a recommendation that all HIV-infected persons boil or otherwise avoid drinking tap water in non-outbreak settings. However, persons who wish to take independent action to reduce their risk for waterborne cryptosporidiosis might take precautions similar to those recommended during outbreaks. Such decisions are best made in conjunction with a health-care provider. Persons who choose to use a personal-use filter or bottled water should be aware of the complexities involved in selecting the appropriate products, the lack of enforceable standards for destruction or removal of oocysts, product cost, and the difficulty of using these products consistently.

Patients taking precautions to avoid acquiring pathogens from drinking water should be advised that ice made from contaminated tap water also can be a source of infection. Patients should also be made aware that fountain beverages served in restaurants, bars, theaters, and other public places also might pose a risk, because these beverages, and the ice they might contain, are usually made from tap water. Nationally distributed brands of bottled or canned water and carbonated soft drinks are safe to drink. Commercially packaged (i.e., sealed at the factory and unopened), non-carbonated soft drinks and fruit juices that do not require refrigeration until after they are opened (i.e., those that can be stored unrefrigerated on grocery

shelves) also are safe. Nationally distributed brands of frozen fruit juice concentrate are safe if they are reconstituted by users with water from a safe source. Fruit juices that must be kept refrigerated from the time they are processed to the time they are consumed might be either fresh (i.e., unpasteurized) or heat treated (i.e., pasteurized); only juices labeled as pasteurized should be considered safe to consume. Other pasteurized beverages and beers also are considered safe.

## Travel-Related Exposures

HIV-infected travelers to developing countries, especially travelers who are severely immunosuppressed, risk exposure to both opportunistic and non-opportunistic pathogens not prevalent in the United States. Health-care providers or specialists in travel medicine (a list can be found at <http://www.istm.com>) should be consulted 4 to 6 weeks in advance of travel to fully review and implement all measures necessary to prevent illness abroad. The Centers for Disease Control and Prevention (CDC) maintain a website accessible to travelers and their care providers at <http://www.cdc.gov/travel> and regularly publishes recommendations for prevention of disease while traveling in the CDC's Yellow Book (Health Information for International Travel).<sup>22</sup> The CDC's travel website allows users to locate prevention recommendations according to geographic destination and to find updates on international disease outbreaks that might pose a health threat to travelers. A detailed review of concerns faced by immunocompromised persons traveling abroad is available at <http://wwwnc.cdc.gov/travel/yellowbook/2012/chapter-8-advising-travelers-with-specific-needs/immunocompromised-travelers.htm> in the Yellow Book.

The following summary advice should be considered for all HIV-infected travelers but does substitute for destination-specific consultation with a travel medicine specialist.

The risk for foodborne and waterborne infections among HIV-infected persons is magnified during travel to economically developing countries. Travelers to such countries may wish to additionally consult the section *Food- and Water-Related Exposures*, above, as well as recommendations for food and water precautions and water disinfection in the CDC Yellow Book (Health Information for Travelers).<sup>22</sup> Specifically, persons who travel to economically developing areas should avoid foods and beverages that might be contaminated, as well as tap water, ice made with tap water, and items sold by street vendors. Raw fruits or vegetables that might have been washed in tap water should be avoided. Foods and beverages that are usually safe include steaming hot foods, fruits that are peeled by the traveler, unopened and properly bottled (including carbonated) beverages, hot coffee and tea, beer, wine, and water that is brought to a rolling boil for 1 minute. Treating water with iodine or chlorine can be as effective as boiling for preventing infections with most pathogens. Iodine and chlorine treatments may not prevent infection with *Cryptosporidium*; however these treatments can be used when boiling is not practical.

Waterborne infections might result from swallowing water during recreational activities. To reduce the risk for parasitic (e.g., cryptosporidiosis, giardiasis, toxoplasmosis) and bacterial infections, patients should avoid swallowing water during swimming and should not swim in water that might be contaminated (e.g., with sewage or animal waste). HIV-infected persons traveling to developing countries should also be advised to **not** use tap water to brush their teeth.

Scrupulous attention to safe food and water consumption and good hygiene (i.e., regularly washing hands with soap and water, or alcohol-based hand sanitizers if soap and water are unavailable) are the most effective methods for reducing risk of travelers' diarrhea. Antimicrobial prophylaxis for travelers' diarrhea **is not recommended** routinely for HIV-infected persons traveling to developing countries. Such preventive therapy can have adverse effects, can promote the emergence of drug-resistant organisms, and can increase the risk of *C. difficile*-associated diarrhea. Nonetheless, studies (none involving an HIV-infected population) have reported that prophylaxis can reduce the risk for diarrhea among travelers. Under selected circumstances (e.g., those in which the risk for infection is high and the period of travel brief), the health-care provider and patient might weigh the potential risks and benefits and decide that antibiotic prophylaxis is warranted.

HIV-infected travelers to developing countries should consider carrying a sufficient supply of an antimicrobial agent to be taken empirically if diarrhea occurs. Antimicrobial resistance among enteric bacterial pathogens outside the United States is a growing public health problem; therefore, the choice of antibiotic should be made in consultation with a clinician based on the traveler's destination. Travelers should consult a physician if they develop severe diarrhea that does not respond to empirical therapy, if their stools contain blood, they develop fever with shaking chills, or dehydration occurs. Antiperistaltic agents (e.g., diphenoxylate and loperamide) are used for treating diarrhea; however, they should not be used by patients with high fever or with blood in the stool, and their use should be discontinued if symptoms persist for more than 48 hours.

Live-virus vaccines should, in general, **not** be used. An exception is measles vaccine, which is recommended for non-immune persons. However, measles vaccine **is not recommended** for persons who are severely immunosuppressed. Severely immunosuppressed persons who must travel to measles-endemic countries should consult a travel medicine specialist regarding possible utility of prophylaxis with immune globulin. Another exception is varicella vaccine, which can be administered to asymptomatic susceptible persons with a CD4 cell count  $\geq 200$  cells/ $\mu\text{L}$ . For adults and adolescents with CD4 cell counts  $< 200$  cells/ $\mu\text{L}$ , varicella-zoster immune globulin (VariZIG™) is indicated after close contact with a person who has active varicella or zoster and anti-herpetic antiviral therapy (e.g., acyclovir, famciclovir, valacyclovir) is recommended in the event vaccination or exposure results in clinical disease (for further details, see Varicella-Zoster Virus Diseases chapter). Persons at risk for and non-immune to polio and typhoid fever or who require influenza vaccination should be administered only inactivated formulations of these vaccines **not** live-attenuated preparations.

Yellow fever vaccine is a live-virus vaccine with uncertain safety and efficacy among HIV-infected persons. Travelers with asymptomatic HIV infection who cannot avoid potential exposure to yellow fever should be offered vaccination. If travel to a zone with yellow fever is necessary and vaccination is not administered, patients should be advised of the risk, instructed in methods for avoiding the bites of vector mosquitoes, and provided a vaccination waiver letter. Preparation for travel should include a review and updating of routine vaccinations, including diphtheria, tetanus, acellular pertussis, and influenza.

Killed and recombinant vaccines (e.g., influenza, diphtheria, tetanus, rabies, HAV, HBV, Japanese encephalitis, meningococcal vaccines) should usually be used for HIV-infected persons just as they would be used for non-HIV-infected persons anticipating travel. Comprehensive and regularly updated information regarding recommended vaccinations and recommendations when a vaccination is contraindicated are listed by vaccine at <http://www.cdc.gov/vaccines/pubs/acip-list.htm>.

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