RABIES Domestic animals, primarily dogs, are the major transmitters of rabies in developing countries (Chap. 232). Several studies have shown that the risk of rabies posed by a dog bite in an endemic area translates into 1–3.6 cases per 1000 travelers per month of stay. Countries where canine rabies is highly endemic include Mexico, the Philippines, Sri Lanka, India, Thailand, China, and Vietnam. The two vaccines available in the United States provide >90% protection. Rabies vaccine is recommended for long-stay travelers, particularly children (who tend to play with animals and may not report bites), and for persons who may be occupationally exposed to rabies in endemic areas; however, in a large-scale study, almost 50% of potential exposures occurred within the first month of travel. Even after receipt of a preexposure rabies vaccine series, two postexposure doses are required. Travelers who have had the preexposure series do not require rabies immune globulin (which is often unavailable in developing countries) if they are exposed to the disease.

PREVENTION OF MALARIA AND OTHER INSECT-BORNE DISEASES

It is estimated that more than 30,000 American and European travelers develop malaria each year (Chap. 248). The risk to travelers is highest in Oceania and sub-Saharan Africa (estimated at 1:5 and 1:50 per month of stay, respectively, among persons not using chemoprophylaxis); intermediate in malarious areas on the Indian subcontinent and in Southeast Asia (1:250–1:1000 per month); and low in South and Central America (1:2500–1:10,000 per month). Of the 1925 cases of malaria reported in 2011 in the United States (the highest figure in 40 years), 90% of those due to *Plasmodium falciparum* occurred in travelers returning or emigrating from Africa and Oceania. VFRs are at the highest risk of acquiring malaria and may die of the disease if their immunity has waned after living outside an endemic area for a number of years. According to data from the CDC, VFRs accounted for 59% of severe malaria cases in the United States in 2011. With the worldwide increase in chloroquine- and multidrug-resistant falciparum malaria, decisions about chemoprophylaxis have become more difficult. The case-fatality rate for falciparum malaria in the United States is 4%; however, *in only one-third of patients who die is the diagnosis of malaria considered before death.*

Several studies indicate that fewer than 50% of travelers adhere to basic recommendations for malaria prevention. Keys to the prevention of malaria include both personal protection measures against mosquito bites (especially between dusk and dawn) and malaria chemoprophylaxis. The former measures entail the use of DEET-containing insect repellents, permethrin-impregnated bed nets and clothing, screened sleeping accommodations, and protective clothing. Thus, in regions where infections such as malaria are transmitted, DEET products (25–50%) are recommended, even for children and infants at birth. Studies suggest that concentrations of DEET above ~50% do not offer a marked increase in protection time against mosquitoes. The CDC also recommends picaridin, oil of lemon eucalyptus (PMD, paramenthane-3,8-diol), and IR3535 (3-[*N*-butyl-*N*-acetyl]-aminopropionic acid, ethyl ester). In general, higher concentrations of any active ingredient provide a longer duration of protection. Personal protection measures also help prevent other insect-transmitted illnesses, such as dengue fever (Chap. 233). Over the past decade, the incidence of dengue has markedly increased, particularly in the Caribbean region, Latin America, Southeast Asia, and (more recently) Africa. Chikungunya, another mosquito-borne infection that clinically resembles dengue fever but with arthralgia and arthritis instead of myalgia, has recently crossed to the Western Hemisphere; many thousands of cases are now occurring in the Caribbean. Both dengue and chikungunya viruses are transmitted by an urban-dwelling mosquito that bites primarily at dawn and dusk.

Table 149-2 lists the currently recommended drugs of choice for prophylaxis of malaria, by destination.

PREVENTION OF GASTROINTESTINAL ILLNESS

Diarrhea, the leading cause of illness in travelers (Chap. 160), is usually a short-lived, self-limited condition. However, 40% of affected individuals need to alter their scheduled activities, and another 20% are confined to bed. The most important determinant of risk is the destination. Incidence rates per 2-week stay have been reported to be as low as 8% in industrialized countries and as high as 55% in parts of Africa, Central and South America, and Southeast Asia. Infants and young adults are at particularly high risk for gastrointestinal illness and for complications such as dehydration. Recent reviews suggest that there is little correlation between dietary indiscretions and the occurrence of travelers' diarrhea. Earlier studies of U.S. students in Mexico showed that eating meals in restaurants and cafeterias or consuming food from street vendors was associated with increased risk. For further discussion, see "Precautions," below.

TABLE 149-2 MALARIA CHEMOSUPPRESSIVE REGIMENS, ACCORDING TO GEOGRAPHIC AREA[a]

Geographic Area	Drug of Choice[b]	Alternatives
Central America (north of Panama), Iraq, Turkey, northern Argentina, and Paraguay	Chloroquine	Atovaquone-proguanil[c] Doxycycline Mefloquine Primaquine
South America (but not northern Argentina or Paraguay, where chloroquine may be used); Central America (only Panama east of the Canal); Asia (including Southeast Asia); Africa; and Oceania	Doxycycline Atovaquone-proguanil[c] Mefloquine	
Thai-Myanmar and Thai-Cambodian borders, central Vietnam	Atovaquone-proguanil[c] Doxycycline	

[a]See CDC's *Health Information for International Travel 2014* (*www.cdc.gov/travel*). [b]In all areas where chloroquine can still be used, the other drugs listed may be used as alternatives. [c]Malarone.

Note: See also Chap. 248.

Etiology (See also Table 160-3) The most frequently identified pathogens causing travelers' diarrhea are enterotoxigenic and enteroaggregative *Escherichia coli* (Chap. 186), although in some parts of the world (notably northern Africa and Southeast Asia) *Campylobacter* infections (Chap. 192) appear to predominate. Other common causative organisms include *Salmonella* (Chap. 190), *Shigella* (Chap. 191), rotavirus (Chap. 227), and norovirus (Chap. 227). The latter virus has caused numerous outbreaks on cruise ships. Except for giardiasis (Chap. 254), parasitic infections are uncommon causes of travelers' diarrhea in short-term travelers. A growing problem for travelers is the development of antibiotic resistance among many bacterial pathogens. Examples include strains of *Campylobacter* resistant to quinolones and strains of *E. coli*, *Shigella*, and *Salmonella* resistant to trimethoprim-sulfamethoxazole *E. coli*. O157 is very rarely a cause of travelers' diarrhea.

Precautions Some experts think that it is not only *what* travelers eat but also where they eat that puts them at risk of illness. Food sold by street vendors can carry a high risk, and restaurant hygiene can be a major problem over which the traveler has no control. In addition to discretion in choosing the source of food and water, general precautions include eating foods piping hot; avoiding foods that are raw or poorly cooked; and drinking only boiled or commercially bottled beverages, particularly those that are carbonated. Heating kills diarrhea-causing organisms, whereas freezing does not; therefore, ice cubes made from unpurified water should be avoided. In spite of these recommendations, the literature has repeatedly documented dietary indiscretions by 98% of travelers within the first 72 h after arrival at their destination. The maxim "Boil it, cook it, peel it, or forget it!" is easy to remember but apparently difficult to follow.

Self-Treatment (See also Table 160-5) As travelers' diarrhea often occurs despite rigorous food and water precautions, travelers should carry medications for self-treatment. An antibiotic is useful in reducing the frequency of bowel movements and the duration of illness in moderate to severe diarrhea. The standard regimen is a 3-day course of a quinolone taken twice daily (or, in the case of some newer