Recommended chemoprophylaxis: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]

NIUE, NEW ZEALAND

YELLOW FEVER VACCINE

Entry requirements: Required for travelers ≥9 months old arriving from countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MALARIA PREVENTION

No malaria transmission

NORFOLK ISLAND, AUSTRALIA

YELLOW FEVER VACCINE

Entry requirements: Required for travelers ≥1 year old arriving from countries with risk for YF virus transmission; this includes >12-hour airport transits or layovers in countries with risk for YF virus transmission[1] Travelers arriving from the Galápagos Islands of Ecuador are exempt from this requirement
CDC recommendation: Not recommended

MALARIA PREVENTION

No malaria transmission

NORTH KOREA

YELLOW FEVER VACCINE

Entry requirements: Required for travelers ≥1 year old arriving from countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MALARIA PREVENTION

Transmission areas: Southern provinces
Drug resistance[2]: None
Species: *P. vivax* (100%)
Recommended chemoprophylaxis: Atovaquone-proguanil, chloroquine, doxycycline, mefloquine, primaquine,[5] tafenoquine[3]

NORTH MACEDONIA

YELLOW FEVER VACCINE

Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION

No malaria transmission

NORTHERN MARIANA ISLANDS (INCLUDING SAIPAN, TINIAN & ROTA), UNITED STATES

YELLOW FEVER VACCINE

Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION

No malaria transmission

NORWAY

YELLOW FEVER VACCINE

Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION

No malaria transmission

OMAN

YELLOW FEVER VACCINE

Entry requirements: Required for travelers ≥9 months old arriving from countries with risk for YF virus transmission, with the addition of Rwanda and Tanzania; this includes >12-hour airport transits or layovers in countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MALARIA PREVENTION

Transmission areas: Rare sporadic transmission after importation only
Drug resistance[2]: Previously, chloroquine
Species: Previously, *P. falciparum* and *P. vivax*
Recommended chemoprophylaxis: None (insect bite precautions and mosquito avoidance only)[4]

PAKISTAN

YELLOW FEVER VACCINE

Entry requirements: Required for travelers ≥1 year old arriving from countries with risk for YF virus transmission; this includes >12-hour airport transits or layovers in countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MALARIA PREVENTION

Transmission areas: All areas (including all cities) <2,500 m (≈8,200 ft) elevation
Drug resistance[2]: Chloroquine
Species: *P. vivax* (80%); *P. falciparum* (20%)
Recommended chemoprophylaxis: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]

PALAU

YELLOW FEVER VACCINE

Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION

No malaria transmission

PANAMA

YELLOW FEVER VACCINE (MAP 2-11)

Entry requirements: Required for travelers ≥1 year old arriving from countries with risk for YF virus transmission[1]
CDC recommendations:
Recommended for travelers ≥9 months old going to all mainland areas east of the Canal Zone including Darién Province, the indigenous provinces (comarcas indígena) of Emberá and Kuna Yala (also spelled Guna Yala), and areas of the provinces of Colón and Panamá, east of the Canal Zone

MAP 2-11 Yellow fever vaccine recommendations for Panama & neighboring countries[1]

[1] For footnotes, see page 84

Not recommended for travel limited to the Canal Zone; areas west of the Canal Zone; Panama City (the capital); Balboa district (Pearl Islands) of Panamá Province; or the San Blas Islands of Kuna Yala Province

MALARIA PREVENTION (MAP 2-12)

Transmission areas: The provinces of Bocas del Toro, Chiriquí, Colón, Darién, Panamá, and Veraguas
The indigenous provinces (*comarcas indígena*) of Emberá, Kuna Yala (also spelled Guna Yala), and Ngäbe-Buglé
No malaria transmission in the province of Panamá Oeste, in the Canal Zone, or in Panama City (the capital)
Drug resistance[2]: Chloroquine (east of the Panama Canal)
Species: *P. vivax* (97%); *P. falciparum* (3%)
Recommended chemoprophylaxis:
Darién, Emberá, Kuna Yala, and eastern Panamá Provinces: Atovaquone-proguanil, doxycycline, mefloquine, primaquine,[5] tafenoquine[3]
Bocas del Toro, Chiriquí, Colón, Veraguas, and Ngäbe-Buglé Provinces: Atovaquone-proguanil, chloroquine, doxycycline, mefloquine, primaquine,[5] tafenoquine[3]

PAPUA NEW GUINEA

YELLOW FEVER VACCINE

Entry requirements: Required for travelers ≥1 year old arriving from countries with risk for YF virus transmission; this includes airport transits or layovers in countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

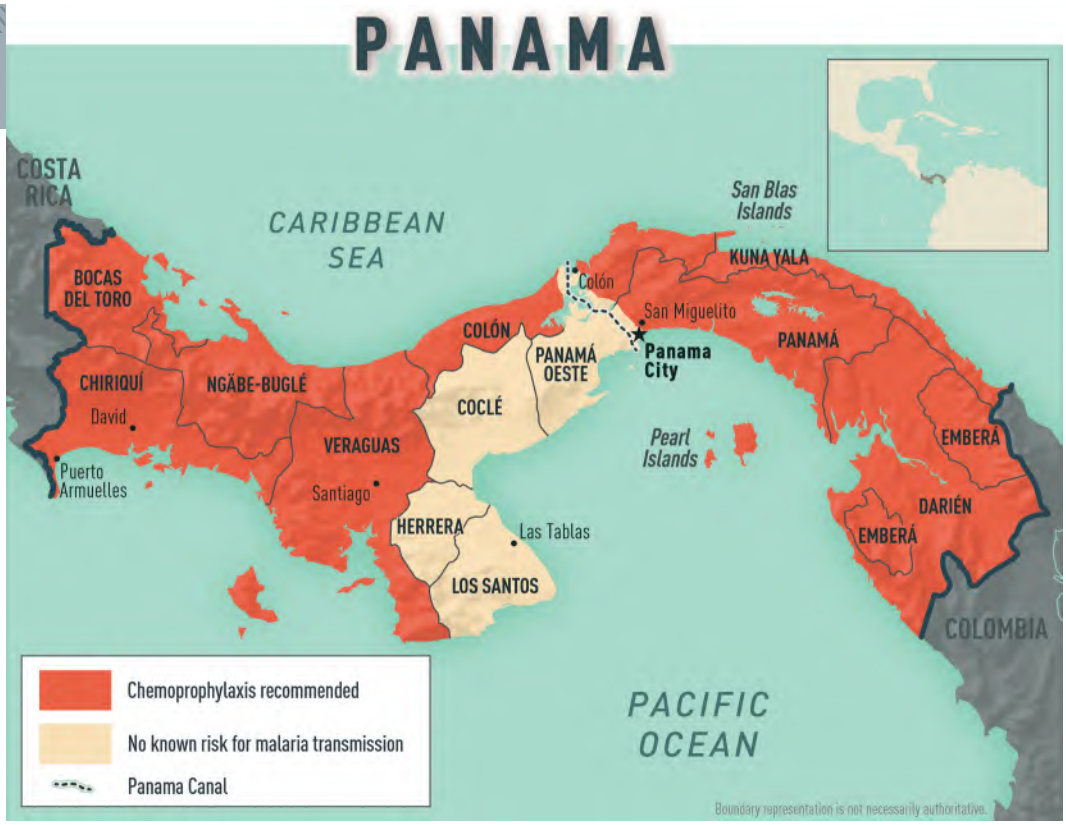
MALARIA PREVENTION

Transmission areas: Throughout the country in areas <2,000 m (≈6,500 ft) elevation
Drug resistance[2]: Chloroquine (both *P. falciparum* and *P. vivax*)
Species: *P. falciparum* (75%); *P. vivax* (25%); *P. malariae* and *P. ovale* (rare)
Recommended chemoprophylaxis: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]

PARAGUAY

YELLOW FEVER VACCINE

Entry requirements: Required for travelers ≥1 year old arriving from Bolivia, Brazil, Peru, or Venezuela; this includes this includes >24-hour transits or layovers in those countries[1]



MAP 2-12 Malaria prevention in Panama

CDC recommendations:
Recommended for all travelers ≥9 months old except as follows
Generally not recommended for travel limited to the city of Asunción (the capital)

MALARIA PREVENTION
No malaria transmission

PERU

YELLOW FEVER VACCINE (MAP 2-13)
Entry requirements: None
CDC recommendations:
Recommended for travelers ≥9 months old going to areas <2,300 m (≈7,550 ft) elevation in the regions of Amazonas, Cusco, Huánuco, Junín, Loreto, Madre de Dios, Pasco, Puno, San Martín, and Ucayali, and designated areas of Ancash (far northeast), Apurímac (far north), Ayacucho (north and northeast), Cajamarca (north and east), Huancavelica (far north), La Libertad (east), and Piura (east)
Generally not recommended for travel limited to the following areas west of the Andes: the regions of Lambayeque and Tumbes, and designated areas of Cajamarca (west-central), and Piura (west)
Not recommended for travel limited to areas >2,300 m (≈7,550 ft) elevation, areas west of the Andes not listed above, the city of Lima (the capital), and the highland tourist areas (the city of Cusco, the Inca Trail, and Machu Picchu)

MALARIA PREVENTION (MAP 2-14)
Transmission areas: All areas of the country <2,500 m (≈8,200 ft) elevation, including the cities of Iquitos and Puerto Maldonado, and only the remote eastern areas in the regions of La Libertad and Lambayeque
No malaria transmission in the following areas: Lima Province; the cities of Arequipa, Ica, Moquegua, Nazca, Puno, or Tacna; the highland tourist areas (the city of Cusco, Machu Picchu, Lake Titicaca); along the Pacific Coast
Drug resistance[2]: Chloroquine
Species: *P. vivax* (80%); *P. falciparum* (20%)
Recommended chemoprophylaxis: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]

PHILIPPINES

YELLOW FEVER VACCINE
Entry requirements: Required for travelers ≥9 months old arriving from countries with risk for YF virus transmission; this includes >12-hour airport transits or layovers in countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MAP 2-13 Yellow fever vaccine recommendations for Peru & neighboring countries[1]

[1] For footnotes, see page 84

MAP 2-14 Malaria prevention in Peru

MALARIA PREVENTION
Transmission areas: Palawan and Mindanao Islands
No malaria transmission in metropolitan Manila (the capital) or other urban areas
Drug resistance[2]: Chloroquine
Species: *P. falciparum* (85%); *P. vivax* (15%); *P. knowlesi*,[6] *P. malariae*, and *P. ovale* (rare)
Recommended chemoprophylaxis: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]

PITCAIRN ISLANDS, UNITED KINGDOM

YELLOW FEVER VACCINE
Entry requirements: Required for travelers ≥1 year old arriving from countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

POLAND

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

PORTUGAL

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

PUERTO RICO, UNITED STATES

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

QATAR

YELLOW FEVER VACCINE
Entry requirements: Required for travelers ≥9 months old arriving from countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

RÉUNION

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

ROMANIA

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

RUSSIA

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

RWANDA

YELLOW FEVER VACCINE
Entry requirements: Required for travelers ≥1 year old arriving from countries with risk for YF virus transmission[1]
CDC recommendation: Generally not recommended for travel to Rwanda

MALARIA PREVENTION
Transmission areas: All
Drug resistance[2]: Chloroquine
Species: *P. falciparum* (primarily); *P. malariae*, *P. ovale*, and *P. vivax* (less commonly)
Recommended chemoprophylaxis: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]

SABA, NETHERLANDS

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

SAINT BARTHELEMY, FRANCE

YELLOW FEVER VACCINE
Entry requirements: Required for travelers ≥1 year old arriving from countries with risk for YF virus transmission; this includes >12-hour airport transits or layovers in countries with risk for YF virus transmission[1]
CDC recommendation: None

MALARIA PREVENTION
No malaria transmission

SAINT HELENA,* UNITED KINGDOM

YELLOW FEVER VACCINE
Entry requirements: Required for travelers ≥1 year old arriving from countries with risk for YF virus transmission[1]

CDC recommendation: Not recommended
*For YF vaccine entry requirements and recommendations and malaria prevention information for Ascension Island and Tristan da Cunha archipelago, see: UNITED KINGDOM (including CHANNEL ISLANDS, ISLE OF MAN, ASCENSION ISLAND & TRISTAN DA CUNHA ARCHIPELAGO)

MALARIA PREVENTION
No malaria transmission

SAINT KITTS (SAINT CHRISTOPHER) & NEVIS

YELLOW FEVER VACCINE
Entry requirements: Required for travelers ≥1 year old arriving from countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

SAINT LUCIA

YELLOW FEVER VACCINE
Entry requirements: Required for travelers ≥9 months old arriving from countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

SAINT MARTIN, FRANCE

YELLOW FEVER VACCINE
Entry requirements: Required for travelers ≥1 year old arriving from countries with risk for YF virus transmission; this includes >12-hour airport transits or layovers in countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

SAINT PIERRE & MIQUELON, FRANCE

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

SAINT VINCENT & THE GRENADINES

YELLOW FEVER VACCINE
Entry requirements: Required for travelers ≥1 year old arriving from countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

SAMOA (FORMERLY WESTERN SOMOA)

YELLOW FEVER VACCINE
Entry requirements: Required for travelers ≥1 year old arriving from countries with risk for YF virus transmission; this includes >12-hour airport transits or layovers in countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

SAN MARINO

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

SÃO TOMÉ & PRÍNCIPE

YELLOW FEVER VACCINE
Entry requirements: Required for travelers ≥1 year old arriving from countries with risk for YF virus transmission; this includes airport transits or layovers in countries with risk for YF virus transmission[1]
CDC recommendation: Generally not recommended for travel to São Tomé & Príncipe

MALARIA PREVENTION
Transmission areas: All
Drug resistance[2]: Chloroquine
Species: *P. falciparum* (primarily); *P. malariae*, *P. ovale*, and *P. vivax* (less commonly)
Recommended chemoprophylaxis: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]

SAUDI ARABIA

YELLOW FEVER VACCINE
Entry requirements: Required for travelers ≥9 months old arriving from countries with risk for YF virus transmission; this includes >12-hour airport transits or layovers in countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MALARIA PREVENTION
Transmission areas: Asir and Jazan (also spelled Jizan) Regions near the Yemen border only
No malaria transmission in the cities of Jeddah, Mecca, Medina, Riyadh (the capital), or Ta'if
Drug resistance[2]: Chloroquine
Species: *P. falciparum* (primarily); *P. vivax* (rare)
Recommended chemoprophylaxis: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]

SENEGAL

YELLOW FEVER VACCINE
Entry requirements: Required for travelers ≥9 months old arriving from countries with risk for YF virus transmission; this includes airport transits

or layovers in countries with risk for YF virus transmission[1]
CDC recommended for all travelers ≥9 months old

MALARIA PREVENTION
Transmission areas: All
Drug resistance[2]: Chloroquine
Species: *P. falciparum* (primarily); *P. malariae*, *P. ovale*, and *P. vivax* (less commonly)
Recommended chemoprophylaxis: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]

SERBIA

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

SEYCHELLES

YELLOW FEVER VACCINE
Entry requirements: Required for travelers ≥1 year old arriving from countries with risk for YF virus transmission; this includes airport transits or layovers in countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

SIERRA LEONE

YELLOW FEVER VACCINE
Entry requirements: Required for all arriving travelers
CDC recommended for all travelers ≥9 months old

MALARIA PREVENTION
Transmission areas: All
Drug resistance[2]: Chloroquine
Species: *P. falciparum* (primarily); *P. malariae*, *P. ovale*, and *P. vivax* (less commonly)
Recommended chemoprophylaxis: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]

SINGAPORE

YELLOW FEVER VACCINE
Entry requirements: Required for travelers ≥1 year old arriving from countries with risk for YF virus transmission; this includes >12-hour airport transits or layovers in countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

SINT EUSTATIUS, NETHERLANDS

YELLOW FEVER VACCINE
Entry requirements: Required for travelers ≥6 months old arriving from countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

SINT MAARTEN, NETHERLANDS

YELLOW FEVER VACCINE
Entry requirements: Required for travelers ≥9 months old arriving from countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

SLOVAKIA

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

SLOVENIA

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

SOLOMON ISLANDS

YELLOW FEVER VACCINE
Entry requirements: Required for travelers ≥9 months old arriving from countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MALARIA PREVENTION
Transmission areas: All
Drug resistance[2]: Chloroquine
Species: *P. vivax* (70%); *P. falciparum* (30%); *P. ovale* (<1%)
Recommended chemoprophylaxis: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]

SOMALIA

YELLOW FEVER VACCINE (MAP 5-10)
Entry requirements: None
CDC recommendations:
Generally not recommended for travel to the regions of Bakool, Banaadir, Bay, Galguduud, Gedo, Hiiraan (also spelled Hiran), Lower Juba (also known as Jubbada Hoose), Middle Juba (also known as Jubbada Dhexe), Lower Shabelle (also known as Shabeellaha Hoose), or Middle Shabelle (also known as Shabeellaha Dhexe)
Not recommended for travel to areas not listed above

MALARIA PREVENTION
Transmission areas: All
Drug resistance[2]: Chloroquine
Species: *P. falciparum* (90%); *P. vivax* (5–10%); *P. malariae* and *P. ovale* (rare)
Recommended chemoprophylaxis: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]

SOUTH AFRICA

YELLOW FEVER VACCINE
Entry requirements: Required for travelers ≥1 year old arriving from countries with risk for YF virus transmission; this includes >12-hour airport transits or layovers in countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MALARIA PREVENTION (MAP 2-15)
Transmission areas: Along the border with Mozambique and Zimbabwe
KwaZulu-Natal Province: uMkhanyakude District; the districts of King Cetshwayo and Zululand (few cases)
Limpopo Province: the districts of Mopani and Vhembe; the districts of Capricorn, Greater Sekhukhune, and Waterberg (few cases)
Mpumalanga Province: Ehlanzeni District
Kruger National Park
Drug resistance[2]: Chloroquine
Species: *P. falciparum* (primarily); *P. malariae*, *P. ovale*, and *P. vivax* (less commonly)
Recommended chemoprophylaxis:
KwaZulu-Natal Province (uMkhanyakude District); Limpopo Province (the districts of Mopani and Vhembe); Mpumalanga Province (Ehlanzeni District); and Kruger National Park: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]
All other areas with malaria transmission (including the districts of King Cetshwayo and Zululand in KwaZulu-Natal Province, and the districts of Capricorn, Greater Sekhukhune, and Waterberg in Limpopo Province): No chemoprophylaxis recommended (insect bite precautions and mosquito avoidance only)[4]

MAP 2-15 Malaria prevention in South Africa

SOUTH GEORGIA & THE SOUTH SANDWICH ISLANDS, UK OVERSEAS TERRITORY (ALSO CLAIMED BY ARGENTINA)

YELLOW FEVER VACCINE

Entry requirements: South Georgia & the South Sandwich Islands has not stated its YF vaccination certificate requirements
CDC recommendation: Not recommended

MALARIA PREVENTION

No malaria transmission

SOUTH KOREA

YELLOW FEVER VACCINE

Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION

Transmission areas: Limited to the months of March–December in rural areas in the northern parts of the provinces of Inch'ŏn (also spelled Incheon), Kangwŏn (also spelled Gangwon), and Kyŏnggi (also spelled Gyeonggi), including the demilitarized zone (DMZ)
Drug resistance[2]: None
Species: *P. vivax* (100%)
Recommended chemoprophylaxis: Atovaquone-proguanil, chloroquine, doxycycline, mefloquine, primaquine,[5] or tafenoquine[3]

SOUTH SUDAN

YELLOW FEVER VACCINE

Entry requirements: Required for all arriving travelers ≥9 months old
CDC recommended for all travelers ≥9 months old

MALARIA PREVENTION

Transmission areas: All
Drug resistance[2]: Chloroquine
Species: *P. falciparum* (primarily); *P. malariae*, *P. ovale*, and *P. vivax* (less commonly)
Recommended chemoprophylaxis: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]

SPAIN

YELLOW FEVER VACCINE

Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION

No malaria transmission

SRI LANKA

YELLOW FEVER VACCINE

Entry requirements: Required for travelers ≥9 months old arriving from countries with risk for YF virus transmission; this includes >12-hour airport transits or layovers in countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MALARIA PREVENTION

No malaria transmission

SUDAN

YELLOW FEVER VACCINE (MAP 5-10)

Entry requirements: None
CDC recommendations:
Recommended for travelers ≥9 months old going to areas south of the Sahara Desert
Not recommended for travel limited to areas in the Sahara Desert or the city of Khartoum (the capital)

MALARIA PREVENTION

Transmission areas: All
Drug resistance[2]: Chloroquine
Species: *P. falciparum* (90%); *P. vivax* (5–10%); *P. malariae* and *P. ovale* (rare)
Recommended chemoprophylaxis: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]

SURINAME

YELLOW FEVER VACCINE

Entry requirements: Required for travelers ≥1 year old arriving from countries with risk for YF virus transmission; this includes >12-hour airport transits or layovers in countries with risk for YF virus transmission[1]
CDC recommended for all travelers ≥9 months old

MALARIA PREVENTION

Transmission areas: Primarily in Sipaliwini District, near the border with French Guiana
Limited transmission in the districts of Brokopondo, Marowijne, and Para (near the border with French Guiana)
No malaria transmission in districts along the Atlantic Coast or in Paramaribo (the capital)
Drug resistance[2]: Chloroquine
Species: *P. vivax* (70%); *P. falciparum* (30%)
Recommended chemoprophylaxis:
Sipaliwini District near the border with French Guiana: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]
All other areas with malaria transmission: No chemoprophylaxis recommended (insect bite precautions and mosquito avoidance only)[4]

SWEDEN

YELLOW FEVER VACCINE

Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION

No malaria transmission

SWITZERLAND

YELLOW FEVER VACCINE

Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION

No malaria transmission

SYRIA

YELLOW FEVER VACCINE

Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION

No malaria transmission

TAIWAN

YELLOW FEVER VACCINE

Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION

No malaria transmission

TAJIKISTAN

YELLOW FEVER VACCINE

Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION

Transmission areas: No indigenous cases reported since 2014
Drug resistance[2]: Previously, chloroquine
Species: Previously, *P. vivax* (90%) and *P. falciparum* (10%)
Recommended chemoprophylaxis: None (insect bite precautions and mosquito avoidance only)[4]

TANZANIA

YELLOW FEVER VACCINE

Entry requirements: Required for travelers ≥1 year old arriving from countries with risk for YF virus transmission; this includes >12-hour airport transits or layovers in countries with risk for YF virus transmission[1]
CDC recommendation: Generally not recommended for travel to Tanzania

MALARIA PREVENTION

Transmission areas: All areas <1,800 m (≈5,900 ft) elevation
Drug resistance[2]: Chloroquine
Species: *P. falciparum* (primarily); *P. malariae* and *P. ovale* (less commonly); *P. vivax* (rare)
Recommended chemoprophylaxis: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]

THAILAND

YELLOW FEVER VACCINE

Entry requirements: Required for travelers ≥9 months old arriving from countries with risk for YF virus transmission; this includes >12-hour airport transits or layovers in countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MALARIA PREVENTION (MAP 2-16)

Transmission areas: Primarily the provinces that border Burma, Cambodia (few cases in Buri Ram Province), and Malaysia (few cases in Satun Province)
Also, the provinces of Phitsanulok and Ubon Ratchathani (bordering Laos), and Surat Thani (especially in the rural forest and forest-fringe areas of these provinces)
Rare to few cases in other parts of Thailand, including the cities of Bangkok (the capital), Chiang Mai, and Chiang Rai, or on the islands of Koh Pha Ngan, Koh Samui, or Phuket
No malaria transmission on the islands of Krabi Province (Ko Lanta, Koh Phi, Koh Yao Noi, Koh Yao Yai) or in Pattaya City
Drug resistance[2]: Chloroquine and mefloquine
Species: *P. vivax* (80%); *P. falciparum* (<20%); *P. knowlesi*,[6] *P. malariae*, and *P. ovale* (rare)
Recommended chemoprophylaxis:
Provinces that border Burma, Cambodia (except Buri Ram Province), and Malaysia (except Satun Province); the provinces of Phitsanulok, Ubon Ratchathani, and Surat Thani: Atovaquone-proguanil, doxycycline, tafenoquine[3]
All other areas with malaria transmission (including the provinces of Buri Ram and Satun):
No chemoprophylaxis recommended (insect bite precautions and mosquito avoidance only)[4]

TIMOR-LESTE

YELLOW FEVER VACCINE

Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION

Transmission areas: Rare cases; outbreak in Indonesia border area in mid-2020
Drug resistance[2]: Previously, chloroquine
Species: Previously, *P. falciparum* (50%), *P. vivax* (50%), *P. ovale* (<1%), and *P. malariae* (<1%)
Recommended chemoprophylaxis: None (insect bite precautions and mosquito avoidance only)[4]

TOGO

YELLOW FEVER VACCINE

Entry requirements: Required for all arriving travelers ≥9 months old
CDC recommended for all travelers ≥9 months old

MALARIA PREVENTION

Transmission areas: All
Drug resistance[2]: Chloroquine
Species: *P. falciparum* (primarily); *P. malariae*, *P. ovale*, and *P. vivax* (less commonly)
Recommended chemoprophylaxis: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]

MAP 2-16 Malaria prevention in Thailand

TOKELAU, NEW ZEALAND

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

TONGA

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

TRINIDAD & TOBAGO

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendations:
Recommended for travelers ≥9 months old going to densely forested areas on Trinidad
Not recommended for cruise ship passengers, airplane passengers in transit, or travel limited to Tobago

MALARIA PREVENTION
No malaria transmission

TUNISIA

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

TURKEY

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

TURKMENISTAN

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

TURKS & CAICOS ISLANDS, UNITED KINGDOM

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

TUVALU

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

UGANDA

YELLOW FEVER VACCINE
Entry requirements: Required for all arriving travelers ≥1 year old
CDC recommended for all travelers ≥9 months old

MALARIA PREVENTION
Transmission areas: All
Drug resistance[2]: Chloroquine
Species: *P. falciparum* (primarily); *P. malariae*, *P. ovale*, and *P. vivax* (less commonly)
Recommended chemoprophylaxis: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]

UKRAINE

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

UNITED ARAB EMIRATES

YELLOW FEVER VACCINE
Entry requirements: Required for travelers ≥9 months old arriving from countries with risk for YF virus transmission; this includes >12-hour airport transits or layovers in countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

UNITED KINGDOM (INCLUDING CHANNEL ISLANDS, ISLE OF MAN, ASCENSION ISLAND & TRISTAN DA CUNHA ARCHIPELAGO)

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

UNITED STATES OF AMERICA

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

URUGUAY

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

UZBEKISTAN

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

VANUATU

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
Transmission areas: All
Drug resistance[2]: Chloroquine
Species: *P. vivax* (75%–90%); *P. falciparum* (10-25%); *P. ovale* (<1%)
Recommended chemoprophylaxis: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]

VENEZUELA

YELLOW FEVER VACCINE (MAP 2-17)
Entry requirements: Required for travelers ≥1 year old arriving from Brazil; this includes >12-hour airport transits or layovers in Brazil

MAP 2-17 Yellow fever vaccine recommendations for Venezuela & neighboring countries[1]

[1] For footnotes, see page 84

CDC recommendations:
Recommended for all travelers ≥9 months old except as follows
Generally not recommended for travel limited to the Distrito Capital or the states of Aragua, Carabobo, Miranda, Vargas, or Yaracuy
Not recommended for travel limited to areas >2,300m (≈7,550 ft) elevation in the states of Mérida, Táchira, or Trujillo; the states of Falcón or Lara; Margarita Island; or the cities of Caracas (the capital) or Valencia

MALARIA PREVENTION
Transmission areas: All areas <1,700 m (≈5,600 ft) elevation and Angel Falls
Drug resistance[2]: Chloroquine
Species: *P. vivax* (75%); *P. falciparum* (25%)
Recommended chemoprophylaxis: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]

VIETNAM

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
Transmission areas: Rural areas only, especially the provinces of Bình Phước, Bình Thuận, Đắk Lắk, Đăk Nông, Gia Lai, Lai Châu, Lâm Đồng, Phú Yên, and Quảng Nam. Rare cases in the Mekong and Red River Deltas
No malaria transmission in the cities of Da Nang, Hai Phong, Hanoi (the capital), Ho Chi Minh City (Saigon), Nha Trang, Quy Nhon
Drug resistance[2]: Chloroquine and mefloquine resistance reported. Emerging resistance to artemisinin in Bình Phước, Đắk Lắk, Đăk Nông, Gia Lai, Khánh Hòa, Ninh Thuận.
Species: *P. vivax* (55%); *P. falciparum* (44%); *P. knowlesi*,[6] *P. malariae*, and *P. ovale* (rare)
Recommended chemoprophylaxis:
The provinces of Bình Phước, Bình Thuận, Đắk Lắk, Đăk Nông, Gia Lai, Lai Châu, Lâm Đồng, Phú Yên, and Quảng Nam: Atovaquone-proguanil, doxycycline, tafenoquine[3]
All other areas with malaria transmission (including provinces in the Mekong and Red River Deltas):
No chemoprophylaxis recommended (insect bite precautions and mosquito avoidance only)[4]

VIRGIN ISLANDS (BRITISH), UNITED KINGDOM

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

VIRGIN ISLANDS (US), UNITED STATES

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

WAKE ISLAND, UNITED STATES

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

WALLIS & FUTUNA, FRANCE

YELLOW FEVER VACCINE
Entry requirements: Required for travelers ≥1 year old arriving from countries with risk for YF virus transmission; this includes >12-hour airport transits or layovers in countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MALARIA PREVENTION
No malaria transmission

YEMEN

YELLOW FEVER VACCINE
Entry requirements: None
CDC recommendation: Not recommended

MALARIA PREVENTION
Transmission areas: All areas <2,000 m (≈6,500 ft) elevation
No malaria transmission in Sana'a (the capital)
Drug resistance[2]: Chloroquine
Species: *P. falciparum* (primarily); *P. malariae*, *P. ovale*, and *P. vivax* (less commonly)
Recommended chemoprophylaxis: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]

ZAMBIA

YELLOW FEVER VACCINE
Entry requirements: Required for travelers ≥1 year of age arriving from countries with risk for YF virus transmission; this includes >12-hour airport transits or layovers in countries with risk for YF virus transmission[1]
CDC recommendations:
Generally not recommended for travel to North-Western Province or Western Province
Not recommended for travel to any areas not listed above

MALARIA PREVENTION
Transmission areas: All
Drug resistance[2]: Chloroquine
Species: *P. falciparum* (primarily); *P. malariae*, *P. ovale*, and *P. vivax* (less commonly)
Recommended chemoprophylaxis: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]

ZIMBABWE

YELLOW FEVER VACCINE

Entry requirements: Required for travelers ≥9 months old arriving from countries with risk for YF virus transmission; this includes >12-hour airport transits or layovers in countries with risk for YF virus transmission[1]
CDC recommendation: Not recommended

MALARIA PREVENTION

Transmission areas: All.
Drug resistance[2]: Chloroquine
Species: *P. falciparum* (primarily); *P. malariae*, *P. ovale*, and *P. vivax* (less commonly)
Recommended chemoprophylaxis: Atovaquone-proguanil, doxycycline, mefloquine, tafenoquine[3]

FOOTNOTES

Yellow Fever Vaccine

[1]Current as of November 2022. This is an update of the 2010 map created by the Informal WHO Working Group on the Geographic Risk of Yellow Fever.

Malaria Prevention

[2]Refers to *Plasmodium falciparum* malaria, unless otherwise noted.

[3]Tafenoquine can cause potentially life-threatening hemolysis in people with glucose-6-phosphate-dehydrogenase (G6PD) deficiency. Rule out G6PD deficiency with a quantitative laboratory test before prescribing tafenoquine to patients.

[4]Mosquito avoidance includes applying topical mosquito repellant, sleeping under an insecticide-treated mosquito net, and wearing protective clothing (e.g., long pants and socks, long-sleeve shirt). For additional details on insect bite precautions, see Sec. 4, Ch. 6, Mosquitoes, Ticks & Other Arthropods.

[5]Primaquine can cause potentially life-threatening hemolysis in people with G6PD deficiency. Rule out G6PD deficiency with a quantitative laboratory test before prescribing primaquine to patients.

[6]*P. knowlesi* is a malaria species with a simian (macaque) host. Human cases have been reported from most countries in Southwest Asia and are associated with activities in forest or forest-fringe areas. *P. knowlesi* has no known resistance to antimalarials.

Yellow Fever Maps

[1]Current as of November 2022. This is an update of the 2010 map created by the Informal WHO Working Group on the Geographic Risk of Yellow Fever.

[2]In 2017, the Centers for Disease Control and Prevention (CDC) expanded its YF vaccination recommendations for travelers going to Brazil because of a large YF outbreak in multiple states in that country. Please refer to the CDC Travelers' Health website (https://wwwnc.cdc.gov/travel/) for more information and updated recommendations.

[3]YF vaccination is *generally not recommended* for travel to areas where the potential for YF virus exposure is low. Vaccination might be considered, however, for a small subset of travelers going to these areas who are at increased risk for exposure to YF virus due to prolonged travel, heavy exposure to mosquitoes, or inability to avoid mosquito bites. Factors to consider when deciding whether to vaccinate a traveler include destination-specific and travel-associated risks for YF virus infection; individual, underlying risk factors for having a serious YF vaccine–associated adverse event; and destination entry requirements.

TRAVELERS' DIARRHEA

Bradley Connor

Travelers' diarrhea (TD) is the most predictable travel-related illness. Attack rates range from 30%–70% of travelers during a 2-week period, depending on the destination and season of travel. Traditionally, TD was thought to be prevented by following simple dietary recommendations (e.g., "boil it, cook it, peel it, or forget it"), but studies have found that people who follow these rules can still become ill. Poor hygiene practices in local restaurants and underlying hygiene and sanitation infrastructure deficiencies are likely the largest contributors to the risk for TD.

TD is a clinical syndrome that can result from a variety of intestinal pathogens. Bacteria are the predominant enteropathogens and are thought to account for ≥80%–90% of cases. Intestinal viruses account for at least 5%–15% of illnesses, although the use of multiplex molecular diagnostic assays demonstrates that their contribution to the overall burden of TD disease is probably greater than previously estimated. Infections with protozoal pathogens are slower to manifest symptoms and collectively account for ≈10% of diagnoses in longer-term travelers (see Sec. 11, Ch. 7, Persistent Diarrhea in Returned Travelers).

What is commonly known as "food poisoning" involves the ingestion of infectious agents that release toxins (e.g., *Clostridium perfringens*) or consumption of preformed toxins (e.g., *Staphylococcal* food poisoning). In toxin-mediated illness, both vomiting and diarrhea can be present; symptoms usually resolve spontaneously within 12–24 hours.

INFECTIOUS AGENTS

Bacteria

Bacteria are the most common cause of TD. Overall, the most common pathogen identified is enterotoxigenic *Escherichia coli*, followed by *Campylobacter jejuni*, *Shigella* spp., and *Salmonella* spp. Enteroaggregative and other *E. coli* pathotypes also are commonly found in cases of TD. Surveillance also points to *Aeromonas* spp., *Plesiomonas* spp., and newly recognized pathogens (*Acrobacter*, enterotoxigenic *Bacteroides fragilis*, *Larobacter*) as potential causes of TD.

Viruses

Viral diarrhea can be caused by several pathogens, including astrovirus, norovirus, and rotavirus.

Protozoal Parasites

Giardia is the main protozoal pathogen found in TD. *Entamoeba histolytica* and *Cryptosporidium* are relatively uncommon causes of TD. The risk for *Cyclospora* is highly geographic and seasonal: the most well-known risks are in Guatemala, Haiti, Nepal, and Peru. *Dientamoeba fragilis* is a flagellate occasionally associated with diarrhea in travelers. Several pathogens are discussed in their own chapters in Section 5.

RISK FOR TRAVELERS

TD occurs equally in male and female travelers; it is more common in young adult travelers than in older travelers. In short-term travelers, bouts of TD do not appear to protect against future attacks, and >1 episode of TD can occur during a single trip. A cohort of expatriates residing in Kathmandu, Nepal, experienced an average of 3.2 episodes of TD per person during their first year. In more temperate regions, seasonal variations in diarrhea risk can occur. In South Asia, for example, much higher TD attack rates are reported during the hot months preceding the monsoon.

Particularly in locations where large numbers of people lack plumbing or latrine access, stool contamination in the environment will be greater and more accessible to disease-transmitting vectors (e.g., flies). Inadequate electrical capacity leading to frequent blackouts or poorly functioning refrigeration can result in unsafe food storage and an additional increased risk for disease. Lack of safe, potable water contributes to food and drink contamination, as do unhealthful shortcuts in cleaning hands, countertops, cutting boards, utensils, and foods (e.g., fruits and vegetables). In

some places, handwashing might not be a social norm and could represent an extra expense; thus, adequately equipped handwashing stations might not be available in food preparation areas.

Where provided, effective food handling courses have been shown to decrease the risk for TD. However, even in high-income countries, food handling and preparation in restaurants has been linked to TD caused by pathogens such as *Shigella sonnei*.

CLINICAL PRESENTATION

The incubation period between exposure and clinical presentation can provide clues to etiology. Toxin-mediated illness, for example, generally causes symptoms within a few hours. By contrast, bacterial and viral pathogens have an incubation period of 6–72 hours. In general, protozoal pathogens have longer incubation periods (1–2 weeks), rarely presenting in the first few days of travel. An exception is *Cyclospora cayetanensis*, which can present quickly in areas of high risk.

Bacterial and viral TD present with the sudden onset of bothersome symptoms that can range from mild cramps and urgent loose stools to severe abdominal pain, bloody diarrhea, fever, and vomiting; with norovirus, vomiting can be more prominent. Diarrhea caused by protozoa (e.g., *E. histolytica*, *Giardia duodenalis*) generally has a more gradual onset of low-grade symptoms, with 2–5 loose stools per day.

Untreated, bacterial diarrhea usually lasts 3–7 days. Viral diarrhea generally lasts 2–3 days. Protozoal diarrhea can persist for weeks to months without treatment. An acute bout of TD can lead to persistent enteric symptoms, even in the absence of continued infection. This presentation is commonly referred to as postinfectious irritable bowel syndrome (see Sec. 11, Ch. 7, Persistent Diarrhea in Returned Travelers). Other postinfectious sequelae can include reactive arthritis and Guillain-Barré syndrome.

PREVENTION

Vaccines are not available in the United States for pathogens that commonly cause TD. Traveler adherence to recommended approaches can, however, help reduce, although never fully eliminate, the risk for illness. These recommendations include making careful food and beverage choices, using agents other than antimicrobial medications for prophylaxis, and carefully washing hands with soap whenever available. When handwashing is not possible, small containers of hand sanitizer containing ≥60% alcohol can make it easier for travelers to clean their hands before eating. Refer to the relevant chapters in Section 5 (Cholera, Hepatitis A, and Typhoid & Paratyphoid Fever) for details regarding vaccines to prevent other foodborne and waterborne infections to which travelers are susceptible.

Food & Beverage Selection

Care in selecting food and beverages can help minimize the risk for acquiring TD. See Sec. 2, Ch. 8, Food & Water Precautions, for detailed food and beverage recommendations. Although food and water precautions are recommended, travelers are not always able to adhere to the advice. Furthermore, food safety factors (e.g., restaurant hygiene) are out of the traveler's control.

Non-Antimicrobial Drugs for Prophylaxis

BISMUTH SUBSALICYLATE

The primary agent studied for prevention of TD, other than antibiotics, is bismuth subsalicylate (BSS), the active ingredient in adult formulations of Pepto-Bismol. Studies from Mexico have shown that this agent, taken either as 2 oz. of liquid or 2 chewable tablets 4 times per day, reduces the incidence of TD by approximately 50%. BSS commonly causes blackening of the tongue and stool and can cause constipation, nausea, and rarely tinnitus.

CONTRAINDICATIONS & SAFETY

Travelers with aspirin allergy, gout, or renal insufficiency, and those taking anticoagulants, methotrexate, or probenecid should not take BSS. In travelers taking aspirin or salicylates for other reasons, concomitant use of BSS can increase the risk of developing salicylate toxicity.

BSS is not generally recommended for children aged <12 years; some clinicians use it off-label, however, with caution to avoid

administering BSS to children aged ≤18 years with viral infections (e.g., influenza, varicella), because of the risk for Reye's syndrome. BSS is not recommended for children aged <3 years or pregnant people.

Studies have not established the safety of BSS use for >3 weeks. Because of the number of tablets required and the inconvenient dosing, BSS is not commonly used as TD prophylaxis.

PROBIOTICS

Probiotics (e.g., *Lactobacillus* GG, *Saccharomyces boulardii*) have been studied in small numbers of people as TD prevention, but results are inconclusive, partly because standardized preparations of these bacteria are not reliably available. Studies of probiotics to prevent TD are ongoing, but data are insufficient to recommend their use (see the Sec. 2, Ch. 14, Complementary & Integrative Health Approaches to Travel Wellness).

Anecdotal reports claim beneficial outcomes after using bovine colostrum as a daily prophylaxis agent for TD. However, commercially sold preparations of bovine colostrum marketed as dietary supplements are not approved by the US Food and Drug Administration (FDA). Because no data from rigorous clinical trials demonstrate efficacy, insufficient information is available to recommend the use of bovine colostrum to prevent TD.

Prophylactic Antibiotics

Older controlled studies showed that use of antibiotics reduced diarrhea attack rates by 90%. For most travelers, though, the risks associated with the use of prophylactic antibiotics (see below) do not outweigh the benefits. Prophylactic antibiotics might rarely be considered for short-term travelers who are high-risk hosts (e.g., immunocompromised people or people who have significant medical comorbidities).

The prophylactic antibiotic of choice has changed over the past few decades as resistance patterns have evolved. Historically, fluoroquinolones have been the most effective antibiotics for prophylaxis and treatment of bacterial TD pathogens, but resistance among *Campylobacter* and *Shigella* species globally now limits their use. In addition, fluoroquinolones are associated with tendinitis, concerns for QT interval prolongation, and an increased risk for *Clostridioides difficile* infection. Current guidelines discourage their use for prophylaxis. Alternative considerations include rifaximin and rifamycin SV.

ANTIMICROBIAL RESISTANCE & OTHER ADVERSE CONSEQUENCES

Prophylactic antibiotics are not recommended for most travelers. Prophylactic antibiotics afford no protection against nonbacterial pathogens and can remove normally protective microflora from the bowel, increasing the risk for infection with resistant bacterial pathogens. Travelers can become colonized with extended-spectrum β-lactamase-producing Enterobacteriaceae (ESBL-PE), a risk that is increased by exposure to antibiotics while abroad (see Sec 2, Ch. 17, . . . *perspectives*: Antibiotics in Travelers' Diarrhea—Balancing Benefit & Risk, and Sec. 11, Ch. 5, Antimicrobial Resistance).

Use of prophylactic antibiotics limits therapeutic options if TD occurs; a traveler relying on prophylactic antibiotics will need to carry an alternative antibiotic to use if severe diarrhea develops. Additionally, use of antibiotics has been associated with allergic and other adverse reactions.

TREATMENT

Antibiotics

The effectiveness of a particular antimicrobial drug depends on the etiologic agent and its antibiotic sensitivity (Table 2-09). If tolerated, single-dose regimens are equivalent to multidose regimens and might be more convenient for the traveler.

AZITHROMYCIN

Azithromycin is an alternative to fluoroquinolones (see below), although enteropathogens with decreased azithromycin susceptibility have been documented in several countries. The simplest azithromycin treatment regimen is a single dose of 1,000 mg, but side effects (mainly nausea) can limit the acceptability of this large dose; taking the medication as 2 divided doses on the same day can help.

Table 2-09 Acute diarrhea antibiotic treatment recommendations[1]

ANTIBIOTIC	DOSE	DURATION
Azithromycin[2,3]	1,000 mg 500 mg QD	Single or divided dose[4] 3 days
Ciprofloxacin	750 mg 500 mg BID	Single dose[4] 3 days
Levofloxacin	500 mg QD	1–3 days[4]
Ofloxacin	400 mg BID	1–3 days[4]
Rifamycin SV[5]	388 mg BID	3 days
Rifaximin[5]	200 mg TID	3 days

Abbreviations: BID, twice daily; QD, once daily; TID, three times a day
[1]Antibiotic regimens can be combined with loperamide 4 mg, initially, followed by 2 mg after each loose stool, not to exceed 16 mg in a 24-hour period.
[2]Use empirically as first-line treatment for travelers' diarrhea in Southeast Asia or other areas if fluoroquinolone-resistant bacteria are suspected.
[3]Preferred treatment for dysentery or febrile diarrhea.
[4]If symptoms are not resolved after 24 hours, continue daily dosing for up to 3 days.
[5]Do not use if clinical suspicion for *Campylobacter*, *Salmonella*, *Shigella*, or other causes of invasive diarrhea. Use may be reserved for patients unable to receive azithromycin or fluoroquinolones.

FLUOROQUINOLONES

Fluoroquinolones (e.g., ciprofloxacin, levofloxacin) have traditionally been the first-line antibiotics for empiric therapy of TD or to treat specific bacterial pathogens. Increasing microbial resistance to fluoroquinolones, however, especially among *Campylobacter* isolates, limits their usefulness in many destinations, particularly South and Southeast Asia, where both *Campylobacter* infection and fluoroquinolone resistance are prevalent. Increasing fluoroquinolone resistance has been reported from other destinations and in other bacterial pathogens, including in *Salmonella* and *Shigella*. Furthermore, fluoroquinolones now carry a black box warning from the FDA regarding multiple adverse reactions including aortic tears, hypoglycemia, mental health side effects, and tendinitis and tendon rupture.

RIFAMYCINS

RIFAMYCIN SV

A new therapeutic option is rifamycin SV, approved by the FDA in November 2018 to treat TD caused by noninvasive strains of *E. coli* in adults. Rifamycin SV is a nonabsorbable antibiotic in the ansamycin class of antibacterial drugs formulated with an enteric coating that targets delivery of the drug to the distal small bowel and colon. Two randomized clinical trials showed that rifamycin SV was superior to placebo and noninferior to ciprofloxacin in the treatment of TD. As with rifaximin (see below), travelers would need to carry a separate antibiotic (e.g., azithromycin) in case of infection due to an invasive pathogen.

RIFAXIMIN

Rifaximin has been approved to treat TD caused by noninvasive strains of *E. coli*. Since travelers likely cannot distinguish between invasive

and noninvasive diarrhea, however, and since they would have to carry a backup drug in the event of invasive diarrhea, the overall usefulness of rifaximin as empiric self-treatment remains undetermined.

ANTIMICROBIAL RESISTANCE & OTHER ADVERSE CONSEQUENCES

Antibiotics are effective in reducing the duration of diarrhea by ≈1–2 days in cases caused by bacterial pathogens susceptible to the antibiotic prescribed. However, concerns about the adverse consequences of using antibiotics to treat TD remain. Travelers who take antibiotics are at risk of becoming colonized by drug-resistant organisms (e.g., ESBL-PE), resulting in potential harm to travelers—particularly immunocompromised people and people prone to urinary tract infections—and the possibility of introducing resistant bacteria into the community.

In addition, antibiotic use can affect the travelers' own microbiota and increase the potential for *C. difficile* infection. These concerns must be weighed against the consequences of TD and the role of antibiotics in shortening the acute illness and possibly preventing postinfectious sequelae. Primarily because of these concerns, an expert advisory panel was convened in 2016 to prepare consensus guidelines on the prevention and treatment of TD. The advisory panel suggested a classification of TD using functional impact for defining severity (Box 2-03) rather than the frequency-based algorithm used traditionally. The guidelines suggest an approach that matches therapeutic intervention with severity of illness, in terms of both safety and effectiveness (Box 2-04).

Antimotility Agents

Antimotility agents provide symptomatic relief and are useful therapy in TD. Synthetic opiates (e.g., diphenoxylate, loperamide) can reduce frequency of bowel movements and therefore enable travelers to ride on an airplane or bus. Loperamide appears to have antisecretory properties as well. The safety of loperamide when used along with an antibiotic has been well established, even in cases of invasive pathogens; however, acquisition of ESBL-PE might be more common when loperamide and antibiotics are coadministered.

Antimotility agents alone are not recommended for patients with bloody diarrhea or those who have diarrhea and fever. Loperamide can be used in children, and liquid formulations are available. In practice, however, these drugs are rarely given to children aged <6 years.

Oral Rehydration Therapy

Fluids and electrolytes are lost during TD, and replenishment is important, especially in young children, older adults, and adults with chronic medical illness. In otherwise healthy adult travelers, severe dehydration from TD is unusual unless vomiting is prolonged. Nonetheless, replacement of fluid losses is key to diarrhea therapy and helps the traveler feel better more quickly. Travelers should remember to use only beverages that are sealed, treated with chlorine, boiled, or are otherwise known to be purified (see Sec. 2, Ch. 9, Water Disinfection).

For severe fluid loss, replacement is best accomplished with oral rehydration solution (ORS) prepared from packaged oral rehydration salts (e.g., those provided by the World Health

BOX 2-03 Acute travelers' diarrhea: functional definitions

MILD DIARRHEA

Tolerable, not distressing, does not interfere with planned activities

MODERATE DIARRHEA

Distressing or interferes with planned activities

SEVERE DIARRHEA

Incapacitating or completely prevents planned activities

All dysentery is considered severe

BOX 2-04 Acute travelers' diarrhea: treatment recommendations

MILD DIARRHEA

Antibiotic treatment not recommended

Consider treatment with bismuth subsalicylate or loperamide

MODERATE DIARRHEA

Antibiotics can be used for treatment

- Azithromycin
- Fluoroquinolones
- Rifaximin (for moderate, noninvasive diarrhea)

Antimotility drugs

- Consider loperamide for use as monotherapy or as adjunctive therapy

SEVERE DIARRHEA

Antibiotic treatment is advised (single-dose regimens may be used)

- Azithromycin is preferred
- Fluoroquinolones or rifaximin[1] can be used for severe, non-dysenteric diarrhea

Antimotility drugs

- Consider loperamide for use as adjunctive therapy
- Not recommended as monotherapy for patients with bloody diarrhea or diarrhea and fever

[1]Treatment recommendations developed prior to the approval of rifamycin SV in the United States; because rifamycin SV is in the same antimicrobial drug category as rifaximin and because both have the same mechanism of action, rifamycin SV can be considered an alternative therapy.

Organization). ORS is widely available at stores and pharmacies in most low- and middle-income countries. ORS is prepared by adding 1 packet to the indicated volume of boiled or treated water—generally 1 liter. Due to their saltiness, travelers might find most ORS formulations relatively unpalatable. In mild cases, rehydration can be maintained with any preferred liquid (including sports drinks), although overly sweet drinks (e.g., sodas) can cause osmotic diarrhea if consumed in quantity.

Travelers' Diarrhea Caused by Protozoa

The most common parasitic cause of TD is *Giardia duodenalis*, and treatment options include metronidazole, nitazoxanide, and tinidazole (see Sec. 5, Part 3, Ch.12, Giardiasis). Amebiasis (see Sec. 5, Part 3, Ch. 1, Amebiasis) should be treated with metronidazole or tinidazole, then treated with a luminal agent (e.g., iodoquinol or paromomycin). Although cryptosporidiosis is usually a self-limited illness in immunocompetent people, clinicians can consider nitazoxanide as a treatment option (see Sec. 5, Part 3, Ch. 3, Cryptosporidiosis). Cyclosporiasis should be treated with trimethoprim-sulfamethoxazole but not trimethoprim alone (see Sec. 5, Part 3, Ch. 5, Cyclosporiasis).

Travelers' Diarrhea in Children

Children who accompany their parents on trips to high-risk destinations can contract TD, and their risk is elevated if they are visiting friends and family. Causative organisms include bacteria responsible for TD in adults, as well as viruses (e.g., norovirus, rotavirus). The main treatment for TD in children is ORS. Infants and younger children with TD are at greater risk for dehydration, which is best prevented by the early initiation of oral rehydration.

Consider recommending empiric antibiotic therapy for bloody or severe watery diarrhea or evidence of systemic infection. In older children and teenagers, treatment guidelines follow those for adults, with possible adjustments in the dose of medication. Among younger children, macrolides (e.g., azithromycin) are considered first-line antibiotic therapy. Rifaximin is approved for use in children aged ≥12 years. Rifamycin SV is approved for use only in adults.

Breastfed infants should continue to nurse on demand, and bottle-fed infants can continue to drink formula. Older infants and children should be encouraged to eat and should consume a regular diet. Children in diapers are at risk for developing diaper rash on their buttocks in response to liquid stool. Barrier creams (e.g., zinc oxide,

petrolatum) could be applied at the onset of diarrhea to help prevent and treat rash; hydrocortisone cream is the best treatment for an established rash. More information about diarrhea and dehydration is discussed in Sec. 7, Ch. 3, Traveling Safely with Infants & Children.

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ANTIBIOTICS IN TRAVELERS' DIARRHEA—BALANCING BENEFIT & RISK

Mark Riddle, Bradley Connor

BENEFIT

For the past 30 years, randomized controlled trials have consistently and clearly demonstrated that antibiotics shorten the duration of illness and alleviate the disability associated with travelers' diarrhea (TD). Treatment with an effective antibiotic shortens the average duration of a TD episode by 1–2 days, and if the traveler combines an antibiotic with an antimotility agent (e.g., loperamide), duration of illness is shortened even further. Emerging data on the potential long-term health consequences of TD (e.g., chronic constipation, dyspepsia, irritable bowel syndrome) might suggest a benefit of early antibiotic therapy given the association between more severe and longer disease and risk for postinfectious consequences.

RISK

Antibiotics commonly used to treat TD have side effects, some of which are severe but rare. Perhaps of greater concern is the recent understanding that antibiotics used by travelers can contribute to changes in the host microbiome and to the acquisition of multidrug-resistant bacteria. Multiple observational studies have found that travelers (in particular, travelers to South and Southeast Asia) who develop TD and take antibiotics are at risk for colonization with extended-spectrum β-lactamase–producing Enterobacteriaceae (ESBL-PE).

The direct effect of colonization on the average traveler appears limited; carriage is most often transient, but it does persist in a small percentage of colonized persons. Elderly travelers (because of the serious consequences of bloodstream infections in this population) and those with a history of recurrent urinary tract infections (because *Escherichia coli* is a common cause) might be at an increased risk for health consequences from ESBL-PE colonization. At a minimum, clinicians should make these travelers aware of the risk and counsel them to convey their travel exposure history to their treating providers if they become ill after travel. Of broader importance, international travel has been associated with subsequent ESBL-PE colonization among close-living contacts, suggesting potentially wider public health consequences from ESBL-PE acquisition during travel.

THE CHALLENGE

The challenge providers and travelers face is how to balance the health benefit of short-course antibiotic treatment of TD with the risk for colonization and global spread of resistance. The role played by travelers in the translocation of infectious disease and resistance cannot be ignored, but the ecology of ESBL-PE infections is complex and includes diet, environment, immigration, and local nosocomial transmission dynamics. ESBL-PE infections are an emerging health threat, and addressing this complex

problem will require multiple strategies, including antibiotic stewardship.

AN APPROACH

Health care providers need to have conversations with travelers about the multilevel (individual, community, global) and multifactorial risks of developing TD: travel, individual behaviors (e.g., hand hygiene), diet (e.g., safe selection of foods and beverages), and other risk avoidance measures. But then, knowing it is often difficult to prevent or even reduce the risk for TD through behaviors and diet alone, what is the most reasonable way to prepare travelers for empiric TD self-treatment before a trip? Clinicians can strongly emphasize reserving antibiotics for moderate to severe TD and using antimotility agents for self-treatment of mild TD.

When it comes to managing TD, we expect the traveler to be both diagnostician and health care provider. For even the most astute traveler, making an appropriately informed decision about their own health can be challenged by the anxiety-provoking onset of that first abdominal cramp in sometimes austere and inconvenient settings. Given that TD counseling is competing with numerous other pretravel health topics that need to be covered, travel medicine providers might want to develop and implement simple messaging, handouts, or easy-to-access electronic health guidance. Providing travelers with clear written guidance about TD prevention and step-by-step instructions about how and when to use medications for TD is crucial.

Though further studies are needed (and many are under way), a rational approach involves using a single-dose regimen of an antibiotic that minimizes microbiome disruption and risk for colonization. Additionally, as travel and untreated TD independently increase the risk for ESBL-PE colonization, nonantibiotic chemoprophylactic strategies (e.g., self-treatment with bismuth subsalicylate), can decrease both the acute and posttravel risk concerns. Strengthening the resilience of the host microbiota to prevent infection and unwanted colonization, as with the use of prebiotics or probiotics, are promising potential strategies but need further investigation.

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. . . *perspectives* chapters supplement the clinical guidance in this book with additional content, context, and expert opinion. The views expressed do not necessarily represent the official position of the Centers for Disease Control and Prevention (CDC).

FOOD & WATER PRECAUTIONS

Brigette Gleason, Vincent Hill, Patricia Griffin

2

Contaminated food and water pose a risk for travelers. Many infectious diseases associated with contaminated food and water are caused by pathogens transmitted via the fecal–oral route. Additional information on pathogens associated with travelers' diarrhea, prophylaxis, and treatment options can be found in Sec. 2, Ch. 6, Travelers' Diarrhea.

FOOD

Travelers should select food with care. Travelers should follow food safety practices recommended in the United States while abroad (www.cdc.gov/foodsafety/keep-food-safe.html). Raw food is especially likely to be contaminated. Raw or undercooked meat, fish, shellfish, and produce can be contaminated with pathogens, and some fish harvested from tropical waters can transmit toxins that survive cooking (see Sec. 4, Ch. 10, Food Poisoning from Marine Toxins).

In areas where hygiene and sanitation are inadequate or unknown, travelers should avoid consuming salads, uncooked vegetables, raw unpeeled fruits, and unpasteurized fruit juices. Fruits that can be peeled are safest when peeled by the person who eats them. Advise travelers to rinse produce with safe water (see Sec. 2, Ch. 9, Water Disinfection); washing with water alone, however, does not remove all pathogens from produce. Foods of animal origin, including meat and eggs, should be cooked thoroughly (www.cdc.gov/foodsafety/keep-food-safe.html), and travelers should select pasteurized milk and milk products, including soft cheeses. In restaurants, inadequate refrigeration and lack of food safety training among staff can result in transmission of pathogens or their toxins. Consumption of food and beverages obtained from street vendors increases the risk of illness. In general, fully cooked foods that are served hot and foods that travelers carefully prepare themselves are safest.

Travelers should not bring perishable food from high-risk areas back to their home country without refrigeration. Moreover, travelers should exercise the same cautions about food and water served on flights as they do for restaurants.

Clinicians should advise travelers to wash their hands with soap and water before preparing or eating food, after using the bathroom or changing diapers, before and after caring for someone who is ill, and after contact with animals or animal environments. When soap and water are not available, travelers should use an alcohol-based hand sanitizer containing ≥60% alcohol, then wash hands with soap and water as soon as possible. Hand sanitizer is not as effective as handwashing for removing some germs, like *Cryptosporidium* or norovirus, and does not work well when hands are visibly dirty or greasy. The Centers for Disease Control and Prevention (CDC) website Handwashing: Clean Hands Save Lives (www.cdc.gov/handwashing) provides additional information.

Feeding Infants

BREASTFEEDING

For infants aged <6 months, the safest way to feed is to breastfeed exclusively. Practicing careful hygiene when using a breast pump can reduce the risk of getting germs into the milk. For details, see How to Keep Your Breast Pump Kit Clean: The Essentials (www.cdc.gov/healthywater/hygiene/healthychildcare/infantfeeding/breastpump.html). For information on malaria prophylaxis for breastfeeding patients see Sec. 5, Part 3, Ch. 16, Malaria, and Sec. 7, Ch. 2, Travel & Breastfeeding.

FORMULA

For infants who get formula, parents should consider using liquid, ready-to-feed formula, which is sterile. When preparing formula from commercial powder, following the manufacturers' instructions

usually is sufficient. Although no powdered formula is sterile, travelers should consider packing enough for their trip because manufacturing standards vary widely around the world.

Formula safety can be increased by reconstituting powder using hot water (≥158°F; ≥70°C); instruct travelers to pack a food thermometer to test water temperature, especially for infants <3 months of age and those with weakened immune systems. Prepared formula should be used within 2 hours of preparation or refrigerated for a maximum of 24 hours. After feeding, any remaining liquid or prepared formula should be discarded.

For more on infant feeding hygiene, see How to Clean, Sanitize, and Store Infant Feeding Items (www.cdc.gov/healthywater/hygiene/healthychildcare/infantfeeding/cleansanitize.html) and *Cronobacter*: Prevention & Control (www.cdc.gov/cronobacter/prevention.html).

WATER

Swallowing, inhaling aerosols of, and having contact with contaminated water can transmit pathogens that cause diarrhea, vomiting, or ear, eye, skin, respiratory, or nervous system infections. Travelers should follow safe water practices recommended in the United States while abroad (www.cdc.gov/healthywater).

Drinking Water & Other Beverages

In many parts of the world, particularly where water treatment, sanitation, and hygiene are inadequate, tap water can contain disease-causing agents, including bacteria, viruses, parasites, or chemical contaminants. Consequently, tap water might be unsafe for drinking, preparing food and beverages, making ice, cooking, and brushing teeth. Infants, young children, pregnant people, older people, and immunocompromised people (e.g., those with HIV or on chemotherapy or certain medications) might be especially susceptible to illness.

Travelers should avoid drinking or putting tap water into their mouths unless they are reasonably certain the water is safe. Similarly, travelers should avoid ice since it may have been prepared with tap water. Box 2-05 provides tips and recommendations of other safe water and beverage practices for travelers.

BOX 2-05 Safe water & beverage practices: a checklist of recommendations for travelers

- ☐ Many people choose to disinfect or filter their water when traveling to destinations where safe tap water might not be available (for details and proper techniques, see Sec. 2, Ch. 9, Water Disinfection).
- ☐ Beverages made with water that has just been boiled (e.g., tea, coffee), generally are safe to drink.
- ☐ Unless further disinfected, tap water safe for drinking is not sterile and should not be used for sinus or nasal irrigation or rinsing, including use in neti pots and for ritual ablution. Never use tap water to clean or rinse contact lenses. Avoid getting tap water in your mouth when showering or bathing.
- ☐ Water that looks cloudy or discolored could be contaminated with chemicals and will not be made safe by boiling or disinfection. In these situations, use bottled water.
- ☐ In areas where tap water could be unsafe, use only commercially bottled water from an unopened, factory-sealed container, or water that has been adequately disinfected for drinking, preparing food and beverages, making ice, cooking, and brushing teeth.
- ☐ When served in unopened, factory-sealed cans or bottles, carbonated beverages, commercially prepared fruit drinks, water, alcoholic beverages, and pasteurized drinks generally can be considered safe. Because surfaces on the outside of cans and bottles might be contaminated, these surfaces should be wiped clean and dried before opening or drinking directly from the container.
- ☐ Beverages that might not be safe for consumption include iced drinks and fountain drinks or other drinks made with tap water. Because ice might be made from contaminated water, ask that all beverages be served without ice.
- ☐ The alcohol content of alcoholic beverages will not kill bacteria in ice made from contaminated water.

Recreational Water

Pathogens that cause gastrointestinal, respiratory, skin, ear, eye, and neurologic illnesses can be transmitted via contaminated recreational freshwater or marine water. Water from inadequately treated pools, hot tubs, spas, or water playgrounds, including splash pads or spray parks, can also be contaminated. Recreational water contaminated by human feces from swimmers, animal waste, sewage, or wastewater runoff can appear clear but still contain disease-causing infectious or chemical agents. Ingesting even small amounts of such water can cause illness. Infectious pathogens (e.g., *Cryptosporidium*) can survive for days, even in well-maintained and safely operated pools, water playgrounds, and hot tubs and spas. To protect other people, children and adults with diarrhea should not enter recreational water.

Maintaining proper pH and free chlorine or bromine concentration is necessary for preventing transmission of most infectious pathogens in water in pools, water playgrounds, and hot tubs or spas. If travelers would like to test recreational water before use, CDC recommends pH 7.2–7.8 and a free available chlorine concentration of 3–10 parts per million (ppm) in hot tubs and spas (4–8 ppm if bromine is used) and 1–10 ppm in pools and water playgrounds (2–10 ppm for aquatic venues using cyanuric acid as a chlorine stabilizer). Travelers can purchase test strips at most superstores, hardware stores, and pool supply stores.

Pseudomonas, which can cause "hot tub rash" or "swimmer's ear," and *Legionella* (see Sec. 5, Part 1, Ch. 9, Legionnaires' Disease & Pontiac Fever) can multiply in hot tubs and spas in which chlorine or bromine concentrations are not adequately maintained. Travelers at increased risk for legionellosis (e.g., people ≥50 years of age, those with immunocompromising conditions), should avoid entering or walking near higher-risk areas (e.g., hot tubs, spas). Travelers also should avoid pools, water playgrounds, and hot tubs or spas where bather limits are not enforced or where the water is cloudy. Additional guidance can be found at CDC's Healthy Swimming website (www.cdc.gov/healthywater/swimming).

Travelers should not swim or wade near storm drains; in water that could be contaminated with human or animal feces, sewage, or wastewater runoff; in lakes or rivers after heavy rainfall; in water that smells bad, looks discolored, or has algal mats, foam, or scum on the surface; in freshwater streams, canals, or lakes in schistosomiasis-endemic areas of Africa, Asia, the Caribbean, and South America (see Sec. 5, Part 3, Ch. 20, Schistosomiasis); in water that might be contaminated with urine from animals infected with *Leptospira* (see Sec. 5, Part 1, Ch. 10, Leptospirosis); or in warm seawater or brackish water (mixture of fresh and sea water), particularly when they have wounds.

Travelers with open wounds should consider avoiding all water contact. Seawater and brackish water can contain pathogens (e.g., *Vibrio* spp.) that can cause wound infections and sepsis. If a sore or open wound comes into contact with untreated recreational water, it should be washed thoroughly with soap and water to reduce the chance of infection. If travelers with wounds do plan water contact, they should cover the wound with a water-repellent bandage.

Naegleria fowleri (www.cdc.gov/parasites/naegleria) is a parasite found around the world in warm freshwater, including lakes, rivers, ponds, hot springs, and locations with water warmed by discharge from power plants and industrial complexes. To help prevent a rare but fatal infection caused by this parasite, travelers should hold their noses shut or wear a nose clip when swimming, diving, or participating in similar activities in warm freshwater. Travelers also should avoid digging in or stirring up sediment, especially in warm water. Clinicians should inform travelers that *Naegleria fowleri* infection also has been linked to use of contaminated tap water for sinus or nasal irrigation.

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WATER DISINFECTION

Howard Backer, Vincent Hill

Waterborne diseases are a risk for international travelers who visit countries where access to safe water, adequate sanitation, and proper hygiene is limited, and for wilderness visitors who rely on surface water in any country, including the United States. In both high-income and low- and middle-income countries, lack of potable water is one of the most immediate public health problems faced after natural disasters (e.g., earthquakes, hurricanes, tsunamis), or in refugee camps. The list of potential waterborne pathogens is extensive and includes bacteria, viruses, protozoa, and parasitic helminths.

Most of the organisms that cause travelers' diarrhea can be waterborne. Many types of bacteria and viruses can cause intestinal (enteric) infection through drinking water. Common waterborne protozoa include *Cryptosporidium*, *Entamoeba histolytica* (the cause of amebic dysentery), and *Giardia*. Parasitic worms are not commonly transmitted through drinking water, but drinking water is a potential means of transmission for some. Respiratory viruses, including coronaviruses like severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), can be passed in feces, but the risk for fecal transmission, including through water, is considered low; for more details, see the US Centers for Disease Control and Prevention (CDC) website on the National Wastewater Surveillance System (NWSS) (www.cdc.gov/healthywater/surveillance/wastewater-surveillance/wastewater-surveillance.html).

International travelers and wilderness visitors have no reliable resources to evaluate local water system quality. Substantial progress has been made toward the goal of safe drinking water and sanitation worldwide, particularly in Asia and Latin America. Seven hundred and eighty million people (11% of the world's population), however, still lack a safe water source; 2.5 billion people lack access to improved sanitation, and >890 million people still practice open defecation.

Where treated tap water is available, aging or inadequate water treatment infrastructure might not effectively disinfect water or maintain water quality during distribution. Some larger hotels and resorts might use additional onsite water treatment to generate potable water. Where untreated surface or well water is used, and no sanitation infrastructure exists, the risk for waterborne infection is high.

All international travelers—especially long-term travelers and expatriates—should become familiar with and use simple methods to ensure

safe drinking water. Bottled water has become the convenient solution for most travelers, but in some places, bottled water might not be superior to tap water. Moreover, plastic bottles create an ecological problem because most low- and middle-income countries do not recycle them. Water disinfection methods that can be applied in the field include use of heat, clarification, filtration, chemical disinfection, and ultraviolet radiation (UVR). Several of these methods are scalable, and some can be improvised from local resources, allowing adaptation to disaster relief and refugee situations. Table 2-10 compares the advantages and disadvantages of the different methods. Additional information on water treatment and disinfection methods can be found at CDC's Water Treatment Options when Hiking, Camping, or Traveling website (www.cdc.gov/healthywater/drinking/travel).

FIELD TECHNIQUES FOR WATER TREATMENT

Heat

Common intestinal pathogens are readily inactivated by heat. Microorganisms are killed in a shorter time at higher temperatures, but temperatures as low as 140°F (60°C) are effective when a longer contact time is used. Pasteurization uses this principle to kill foodborne enteric pathogens and spoilage-causing organisms at temperatures between 140°F (60°C) and 158°F (70°C), well below the boiling point of water (212°F [100°C]).

Boiling is not necessary to kill common intestinal pathogens, but boiling is the only easily recognizable end point that does not require a thermometer. All organisms, except bacterial spores (which are rarely waterborne enteric pathogens), are killed within seconds at boiling temperature. In addition, the time required to heat the water from 140°F (60°C) to boiling works toward heat disinfection. Any water brought to a boil should be adequately disinfected; if fuel supplies are adequate, however, CDC recommends that travelers boil water for a full minute to account for user variability in identifying boiling points and to add a margin of safety.

Although the boiling point for water decreases with increasing elevation, at common terrestrial travel elevations, the temperature needed to achieve boiling is still well above the temperature required to inactivate enteric pathogens. For example, at 16,000 ft (≈4,900 m) elevation, the boiling temperature of water is 182°F (≈83°C). In hot climates with sunshine, a water container placed in a simple reflective solar oven can reach pasteurization temperatures of 150°F (≈65°C).

Travelers with access to electricity can bring a small electric heating coil, and many hotels have electric water pots to brew tea or coffee. When possible, travelers should avoid using water from the hot water tap for drinking or food preparation, because hot tap water can contain higher levels of metals, like copper and lead, that leach from the building's water heater and pipes.

Clarification

Clarification refers to techniques that reduce the cloudiness (turbidity) of water caused by the presence of natural organic and inorganic material. Clarification can markedly improve both the appearance and taste of the water. Decreasing turbidity is an indicator that microbiological contamination will also be reduced, but not enough to ensure water potability; clarification techniques facilitate disinfection by filtration or chemical treatment.

COAGULATION & FLOCCULATION

Large particles like silt and sand will settle by gravity (sedimentation). Cloudiness due to dissolved substances or smaller particles that remain suspended in water can be improved by using chemical products that coagulate and flocculate (i.e., cause clumping). This process removes many, but not all, microorganisms unless the product also contains a disinfectant.

Alum, an aluminum salt widely used in food, cosmetic, and medical applications, is the principal agent for coagulation/flocculation. Travelers should add one-fourth teaspoon (1/4 tsp) of alum powder to 1 quart (32 oz; .95 L) of cloudy water; stir frequently for a few minutes and add more powder as necessary until clumps form. Allow the clumped material to settle into the bottom of the container, and then pour the water through a coffee filter or clean, fine cloth to remove the sediment. Since most microbes are removed but not all, travelers must use a second disinfection step.

Table 2-10 Water disinfection techniques: advantages & disadvantages

TECHNIQUE	ADVANTAGES	DISADVANTAGES
HEAT	Does not impart additional taste or color. Single-step process that inactivates all enteric pathogens. Efficacy not compromised by contaminants or particles in the water.	Does not improve taste, odor, or appearance of water. Fuel sources might be scarce, expensive, or unavailable. No residual protection; does not prevent stored water from recontamination.
FILTRATION	Simple to operate. Does not require holding time for treatment; water can be consumed immediately after filtering. Many commercial product designs available. Adds no unpleasant taste; often improves water taste and appearance. Can be combined with chemical disinfection to increase microbe removal.	Adds bulk and weight to baggage. Many filters do not reliably remove viruses. More expensive than chemical treatment. Eventually clogs from suspended particulate matter and might require some field maintenance or repair. No residual protection; does not prevent stored water from recontamination.
CHEMICAL DISINFECTION: HALOGENS & ELECTROLYTIC SOLUTIONS	Inexpensive. Widely available in liquid or tablet form. Bad taste can be removed by simple techniques. Flexible dosing. Equally easy to treat large and small volumes. Residual protection; can prevent stored water from recontamination.	Imparts taste and odor to water. Flexible dosing requires understanding of principles of chemical disinfection. Iodine is physiologically active and has potential adverse health effects. Not readily effective against *Cryptosporidium* oocysts. Efficacy decreases with cloudy water. Liquid disinfectants are corrosive and can stain clothing.
CHEMICAL DISINFECTION: CHLORINE DIOXIDE	Low doses impart no taste or color to water. Simple to use and available in liquid or tablet form. More potent than equivalent doses of chlorine. Effective against all waterborne pathogens, including *Cryptosporidium*.	Volatile and sensitive to sunlight; do not expose tablets to air; rapidly use chlorine dioxide solutions. No residual protection; does not prevent stored water from recontamination. Requires several hours contact time for disinfection.
ULTRAVIOLET RADIATION (UVR)	Imparts no taste, odor, or color to water. Portable battery-operated devices are available. Effective against all waterborne pathogens. Extra doses of UVR can be used for added assurance and with no side effects.	Requires clear (not cloudy or turbid) water. Does not improve taste or appearance of water. Relatively expensive, except solar disinfection (SODIS) method. Requires batteries or power source (except SODIS). Cannot know if devices are delivering required UVR doses. No residual protection; does not prevent stored water from recontamination.

Some commercially available tablets or powder packets combine a flocculant with a chemical disinfectant. Travelers should check their product to determine whether they need additional disinfection.

Filtration

Portable hand-pump or gravity-drip filters with various designs and types of filter media are commercially available to international travelers. Filter pore size is the primary determinant of a filter's effectiveness (see Figure 2-01). Manufacturers claiming a US Environmental Protection Agency (EPA) designation of water "purifier" for their products must conduct their own testing to demonstrate their filters can remove at least 10^6 bacteria (99.9999%), 10^4 viruses (99.99%), and 10^3 *Cryptosporidium* oocysts or *Giardia* cysts (99.9%). The EPA does not independently test the validity of these claims.

FILTER PORE SIZE

Most portable filters are microfilters with a pore size <1 μm, which should readily remove bacteria and protozoan parasites like *Cryptosporidium* and *Giardia*. Travelers should not expect portable microfilters to effectively remove enteric viruses (e.g., norovirus) with an average size of 0.03 μm (see Table 2-11).

For areas with high levels of human and animal activity in the watershed or in places with poor sanitation, travelers should use higher levels of filtration or other techniques to remove viruses. If using a microfilter, travelers can pretreat water with chlorine to remove viruses. Progressively finer levels of filtration, known as ultrafiltration, nanofiltration, and reverse osmosis, all can remove viruses (see Figure 2-01). Ultrafilters with pore size of 0.01 μm should be effective for removing viruses, bacteria, and parasites. Other available portable ultrafilters use hollow-fiber

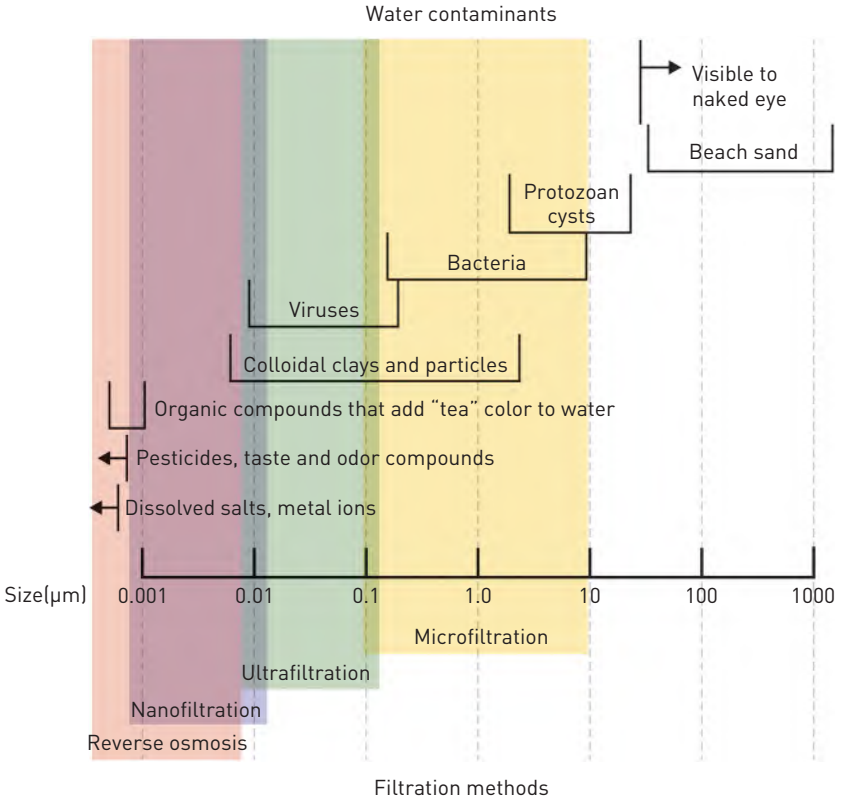

FIGURE 2-01. Water contaminants: particle sizes & filtration methods

Source: Auerbach PS, ed. Wilderness Medicine, 7th edition. Philadelphia: Elsevier; 2017.

Table 2-11 Waterborne pathogens (average sizes) & filter pore size needed to achieve disinfection

WATERBORNE PATHOGEN	AVERAGE SIZE (µM)	FILTER PORE SIZE NEEDED (µM)	FILTER CLASS
Viruses	0.03	Not specified (optimally ≤0.01)	Ultrafilter
Enteric bacteria (e.g., *Escherichia coli*)	0.5 × 2–8	≤0.2–0.4	Microfilter
Cryptosporidium oocysts	4–6	≤1	Microfilter
Giardia cysts	8 × 19	≤3.0–5.0	Microfilter
Helminth eggs	30 × 60	Not specified	Any
Schistosome larvae	50 × 100	Not specified	Any

technology that operate by gravity, hand-pump, or drink-through methods. Nanofilters have rated pore sizes of 0.001 µm and will remove chemicals and organic molecules from water. Reverse osmosis filters have a pore size of ≤0.0001 µm (0.1 nm) and will remove monovalent salts and dissolved metals, achieving water desalination. Progressively smaller pore size filters are available; however, these filters are both more costly and require greater pressures to push water through the filter, often at a slower rate. For these reasons, small hand-pump reverse osmosis units can be a challenge for land-based travelers to use, but they are a viable survival aid for ocean voyagers; military and refugee camps use larger, powered devices.

ACTIVATED CHARCOAL, CLAY, SAND & GRAVEL

Many household and field filters include granular activated charcoal (GAC), which further treats water by adsorbing organic and inorganic chemicals, including chlorine and iodine compounds, and most heavy metals, thereby improving odor, taste, and safety. GAC filters trap, but do not kill, microorganisms, and they are generally not rated for microbe removal.

In resource-limited international settings, communities and households might use filters made from ceramic clay or simple sand and gravel (slow sand or biosand). When no other means of disinfection is available in remote or austere situations, travelers and wilderness visitors can improvise an emergency gravel and sand filter using a 20-liter (≈5.5 gallon) bucket (see Figure 2-02).

Chemical Disinfection

HALOGENS

CHLORINE COMPOUNDS & IODINE

Chemical disinfectants for drinking water treatment, including chlorine compounds, iodine, and chlorine dioxide, commonly are available as commercial products. Sodium hypochlorite, the active ingredient in common household bleach, has been used for over a century and is the primary disinfectant promoted by CDC and the World Health Organization (WHO). Other chlorine-containing compounds, widely available in granular or tablet formulations (e.g., calcium hypochlorite and sodium dichloroisocyanurate), are equally effective for water treatment.

An advantage of chemical water disinfection products is flexible dosing that enables their use by individual travelers, small or large groups, or communities. In emergency situations, or when other commercial chemical disinfection water treatment products are not available, household bleach can be used with flexible dosing based on water volume and clarity. Refer to CDC recommendations at www.cdc.gov/healthywater/emergency/drinking/making-water-safe.html.

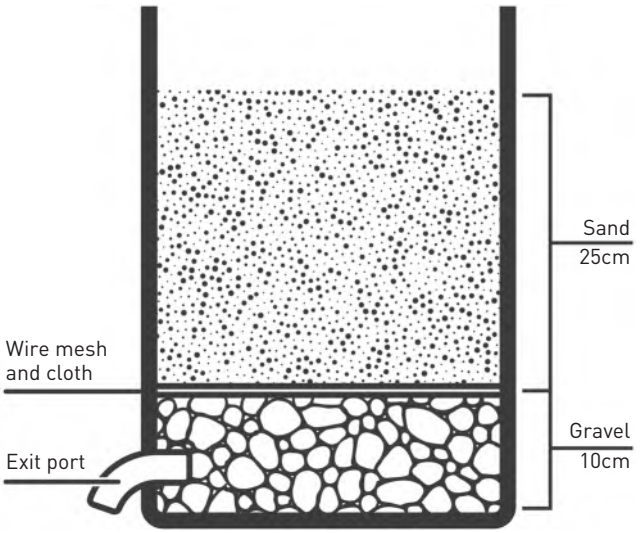

FIGURE 2-02. Emergency gravel and sand filter

Gravel and sand filters are constructed by forming layers of aggregate increasing from very fine sand at the top to large gravel at the bottom near the exit port. An emergency sand filter can be made in a 20 L (≈5 gal) bucket, composed of a 10-centimeter (≈4 inch) layer of gravel beneath a 25-centimeter (≈10 inch) layer of sand; a layer of cotton cloth, sandwiched between two layers of wire mesh, separates the sand and gravel layers.

Given adequate concentrations and length of exposure (contact time), chlorine and iodine have similar activity and are effective against bacteria and viruses (see Effect of Chlorination on Inactivating Selected Pathogens, www.cdc.gov/safewater/effectiveness-on-pathogens.html). Although *Giardia* cysts are more resistant than other bacteria and viruses to chemical disinfection, field-level concentrations of chlorine and iodine are effective against this parasite when longer contact times are used. For this reason, dosing and concentrations of chemical disinfection products are generally targeted at *Giardia* cysts.

Another common protozoan parasite, *Cryptosporidium*, is poorly inactivated by chlorine- or iodine-based disinfection at practical concentrations, even with extended contact times. Chemical disinfection can be supplemented with filtration to remove these resistant oocysts from drinking water.

Cloudy water contains disinfectant-neutralizing substances and requires higher concentrations or contact times with chemical disinfectants. Advise travelers to clarify cloudy water using settling, coagulation/flocculation, or filtration (described above) before adding the disinfectant.

Because iodine has physiologic activity, WHO recommends limiting drinking iodine-disinfected water to a few weeks. People with unstable thyroid disease or known iodine allergy should not use iodine for chemical disinfection. In addition, pregnant people should not use iodine to disinfect water for prolonged periods of time because of potential adverse effects on the fetal thyroid. Advise pregnant travelers to use an alternative method of water disinfection (e.g., heat, chlorination, filtration).

Taste preference for iodine over chlorine is individual; neither is particularly palatable in doses recommended for field use. The taste of halogen-treated water can be improved by running the water through a filter containing GAC, by adding a pinch of powdered ascorbic acid (vitamin C), or by adding 5–10 drops of 3% hydrogen peroxide per quart (32 oz; ≈1 L) of water, then stirring or shaking, which can be repeated until the taste of chlorine or iodine is gone.

CHLORINE DIOXIDE

Chlorine dioxide (ClO_2) kills most waterborne pathogens, including *Cryptosporidium* oocysts, at

practical doses and contact times. Several commercial ClO_2 products are available in liquid or tablet form, but relatively few data are available on testing of these products for different water conditions.

SALT (SODIUM CHLORIDE) ELECTROLYSIS

Electrolytic water purifiers generate a mixture of oxidants, including hypochlorite, by passing an electrical current through a simple brine salt solution. Commercially available small units use salt, water, and a 12-volt DC (automobile) battery to quickly create a chlorine solution that can be used treat ≤200 liters of water.

SILVER & OTHER PRODUCTS

Silver ion has bactericidal effects in low doses; attractive features include lack of color, taste, and odor, and the ability of a thin coating on a container to maintain a steady, low concentration in water. Silver ion concentration in water can be strongly affected by adsorption onto the surface of the container, and limited testing on viruses and cysts has been performed. Silver is widely used by European travelers as a drinking water disinfectant, but in the United States, silver is approved only for maintaining microbiologic quality of stored water. Silver is available alone or in combination with chlorine in tablet formulation.

Several other common products, including hydrogen peroxide, citrus juice, and potassium permanganate, have antibacterial effects in water and are marketed in commercial products for travelers. However, none has sufficient data to recommend them for water disinfection at low doses in the field.

Ultraviolet Radiation

Ultraviolet radiation (UVR) kills bacteria, viruses, and *Cryptosporidium* oocysts in water; efficacy depends on dose and exposure time. Moreover, because suspended particles can shield microorganisms from UVR, UVR units have limited effectiveness in disinfecting water with high levels of suspended solids and turbidity.

In the field, portable battery-operated units capable of delivering a metered, timed dose of UVR are an effective way to disinfect 1–2 liters of clear water at a time. Larger units with greater outputs are available for use in places where a power source is available.

SOLAR IRRADIATION

Using sunlight to irradiate water (solar disinfection or SODIS) can improve the microbiologic quality of water and can be used in austere emergency situations. Because UVR is blocked by particles, travelers should clarify highly

Table 2-12 Field water disinfection techniques: effectiveness against waterborne pathogens

TECHNIQUE	BACTERIA	VIRUSES	PROTOZOAN CYSTS (e.g., *GIARDIA*, AMEBAS)	*CRYPTOSPORIDIUM*	HELMINTHS & SCHISTOSOMES
HEAT	+	+	+	+	+
FILTRATION[1]	+	+/–	+	+	+
HALOGENS[2,3]	+	+	+	–	+/–
CHLORINE DIOXIDE	+	+	+	+	+

[1]Many filters make no claims for viruses. Hollow-fiber filters with ultrafiltration pore size of 0.01 µm and reverse osmosis are effective.
[2]Higher concentrations and longer contact time are required to disinfect waterborne protozoan cysts than bacteria or viruses.
[3]Helminth eggs are not very susceptible to chlorine or iodine, but risk for waterborne transmission is very low.

turbid water first. The optimal procedure is to use transparent bottles (e.g., clear plastic beverage bottles) laid on their side and exposed to sunlight for a minimum of 6 hours with intermittent agitation. Under cloudy weather conditions, water must be placed in the sun for 2 consecutive days. The Swiss Federal Institute of Aquatic Sciences and Technology provides more details on SODIS (see www.sodis.ch/index_EN for more details).

CHOOSING A DISINFECTION TECHNIQUE

Table 2-12 summarizes advantages and disadvantages of field water disinfection techniques and their microbicidal efficacy. Travelers can use a UVR-generating device or liquid bleach (1–2 drops of per quart [liter] of water) to disinfect tap water. Trekkers or campers might prefer to use filters rated to remove viruses. Advise travelers to practice disinfection methods before leaving for their destination.

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TRAVEL HEALTH KITS

Aisha Rizwan

Regardless of their destination, international travelers should assemble and carry a travel health kit. Travelers should tailor the contents to their specific needs, the type and length of travel, and their destination(s). Kits can be assembled at home or purchased at a local store, pharmacy, or online. Travel health kits can help to ensure travelers have supplies they need to manage preexisting medical conditions and treat any exacerbations of these conditions, prevent illness and injury related to traveling, and take care of minor health problems as they occur.

TRAVELING WITH MEDICATIONS

Instruct international travelers to carry all medications in their original containers with clear labels that easily identify the contents, the patient's name, and dosing regimen information. Although travelers might prefer packing their medications into small bags, pillboxes, or daily-dose containers, officials at ports of entry might require that medications be in their original prescription containers.

Travelers should carry copies of all prescriptions, including generic names, preferably

translated into the local language of the destination. For controlled substances and injectable medications, travelers should carry a note on letterhead stationery from the prescribing clinician or travel clinic. Translating the letter into the local language at the destination and attaching the translation to the original document could prove helpful if the document is needed during the trip. Some countries do not permit certain medications. For questions about medication restrictions, particularly regarding controlled substances, travelers should contact the US embassy or consulate of the destination country (www.usembassy.gov).

A travel health kit is useful only when it is easily accessible. Travelers should always carry the kit with them (e.g., in a carry-on bag); sharp objects like scissors and fine splinter tweezers must remain in checked luggage, however. Travelers should make sure that any liquid or gel-based items packed in carry-on bags do not exceed size limits, although exceptions are made for certain medical reasons. For more information, call the Transportation Security Administration (TSA) at 866-289-9673 (toll-free, Monday–Friday, 8 a.m. to 11 p.m., and weekends and holidays 9 a.m. to 8 p.m.) or see the TSA Customer Service webpage (www.tsa.gov/contact/customer-service). The US embassy or consulate at the destination country can also provide details.

SUPPLIES FOR PREEXISTING MEDICAL CONDITIONS

Travelers with preexisting medical conditions should carry enough medication for the duration of their trip and an extra supply in case the trip extends for any reason. If additional supplies (e.g., glucose monitoring items) or medications are needed to manage exacerbations of existing medical conditions, these should be carried as well (see Sec. 3, Ch. 3, Travelers with Chronic Illnesses). People with preexisting conditions (e.g., allergies, diabetes), should consider wearing an alert bracelet. Needles and syringes can be difficult to purchase in some locations, so travelers should take more than needed for the length of the trip. In addition, travelers needing needles and syringes will also be required to carry a letter from the prescribing clinician on letterhead stationery.

GENERAL TRAVEL HEALTH KIT SUPPLIES

Boxes 2-06, 2-07, 2-08, 2-09, and 2-10 provide sample checklists of items travelers might consider including in their basic travel health kits. Provide travelers with needed details and instructions about any prescribed medications, including antibiotics for self-treatment of diarrhea, medications to treat altitude illness, and malaria chemoprophylaxis. Relevant chapters of this book offer additional suggestions for travel health kit contents depending on underlying health issues,

BOX 2-06 Sample travel health kit checklist for travelers: prescription medicines & medical supplies

- ☐ Antibiotics for self-treatment of moderate to severe travelers' diarrhea (if prescribed)
- ☐ Antihistamines, epinephrine auto-injectors (e.g., an EpiPen 2-Pak), short course of oral steroid medications (for travelers, including children, with a history of severe allergic reactions or anaphylaxis)
- ☐ Antimalarial medication (if prescribed)
- ☐ Insulin and diabetes testing supplies
- ☐ Medicine to prevent or treat altitude illness (if prescribed)
- ☐ Needles or syringes (plus extras) for injectable medicines
- ☐ Prescription glasses/contact lenses (consider packing an extra pair of each)
- ☐ Prescription medicines taken regularly at home
- ☐ Sleep aids (if prescribed)

Pack all prescription medicines (+ a copy of the prescription) and any necessary medical supplies in a carry-on bag. Medicines should be in their original containers with labels that clearly identify contents, patient name, and dosing information. Consider wearing a medical alert bracelet or necklace if you have chronic illnesses or underlying health conditions.

BOX 2-07 Sample travel health kit checklist for travelers: over-the-counter medications

- ☐ Over-the-counter medicines taken regularly at home
- ☐ Medicines for pain or fever, for example:
  - ○ Acetaminophen
  - ○ Aspirin
  - ○ Ibuprofen
- ☐ Medicines (not antibiotics) for stomach upset or diarrhea, for example:
  - ○ Antidiarrheal medication (e.g., loperamide [Imodium] or bismuth subsalicylate [Pepto-Bismol])
  - ○ Packets of oral rehydration salts for dehydration
  - ○ Mild laxatives
  - ○ Antacids
- ☐ Medicines for mild upper respiratory conditions, for example:
  - ○ Antihistamine
  - ○ Decongestant, alone or in combination with antihistamine
  - ○ Cough suppressant or expectorant
  - ○ Cough drops
- ☐ Medicines for motion sickness
- ☐ Sleep aids (non-prescription)
- ☐ Eye drops
- ☐ Nose drops or spray

BOX 2-08 Sample travel health kit checklist for travelers: basic first aid

- ☐ Adhesive bandages and tape, multiple sizes
- ☐ Antifungal and antibacterial spray or creams
- ☐ Anti-itch gel or cream for insect bites and stings
- ☐ Antiseptic wound cleanser
- ☐ Commercial suture kit (for travel to remote areas)
- ☐ Cotton swabs
- ☐ Digital thermometer
- ☐ Disposable latex-free gloves
- ☐ Elastic/compression bandage wrap for sprains and strains
- ☐ First aid quick reference card
- ☐ Gauze
- ☐ Hydrocortisone cream (1%)
- ☐ Moleskin or molefoam for blister prevention and treatment
- ☐ Safety pins
- ☐ Scissors (pack sharp metal objects in checked baggage; small, rounded tip bandage scissors might be available for purchase in certain stores or online)
- ☐ Triangular bandage to wrap injuries and to make an arm or shoulder sling
- ☐ Tweezers (pack sharp metal objects in checked baggage)

BOX 2-09 Sample travel health kit checklist for travelers: supplies to prevent illness & injury

- ☐ Antibacterial hand wipes or an alcohol-based hand sanitizer containing ≥60% alcohol
- ☐ Ear plugs
- ☐ Face masks
- ☐ Insect repellents for skin and clothing
- ☐ Latex condoms
- ☐ Mosquito net (for protection against insect bites while sleeping; can be pretreated with insect repellent)
- ☐ Personal safety equipment (for example, child safety seats, bicycle or motorcycle helmets)
- ☐ Sun protection (for example, protective clothing, sunglasses, sunscreen)
- ☐ Water purification method(s) if visiting remote areas, camping, or staying in areas where access to clean water is limited

BOX 2-10 Sample travel health kit checklist for travelers: documents

- ☐ Contact information card (carry at all times) that includes the street addresses, telephone numbers, and email addresses of:
  - ○ Family member or close contact remaining in the United States
  - ○ Health care provider(s) at home
  - ○ Hospitals or clinics (including emergency services) at your destination(s)
  - ○ Insurance policy information
  - ○ Lodging at the destination(s)
  - ○ US embassy or consulate address and telephone number in your destination country or countries
- ☐ Copies of all prescriptions for medications, eyeglasses/contacts, and other medical supplies, including generic names; preferably translated into the local language of the destination
- ☐ Documentation of preexisting conditions (for example, diabetes or allergies) in English and preferably translated into the local language of the destination
- ☐ Electrocardiogram (EKG) if you have existing heart disease, including any known abnormal heart rhythms (arrhythmias)
- ☐ Health insurance, supplemental travel health insurance, medical evacuation insurance, and travel insurance policy numbers, carrier contact information, and copies of claim forms
- ☐ International Certificate of Vaccination or Prophylaxis (ICVP) card showing proof of vaccination, or an appropriate medical waiver, for travel to destinations where vaccinations are required by the country for entry

In addition to bringing the medical documents on this list, be sure to leave copies with a family member or close contact who will remain in the United States (in case of an emergency). Consider having electronic copies of documents, as well.

itinerary, and planned activities or intended reasons for travel.

TRAVEL KITS WHEN TRAVELING WITH CHILDREN

Box 2-11 provides a checklist of items travelers might consider bringing if they are traveling with children.

COMMERCIAL MEDICAL KITS

Travelers can obtain commercial medical kits for a wide range of circumstances, from basic first aid to advanced emergency life support. Companies also manufacture advanced medical kits for adventure travelers, customizing them based on specific travel needs. In addition, specialty kits are available for travelers managing diabetes, dealing with dental emergencies, and participating in aquatic activities. Many pharmacy, grocery, retail, and outdoor sporting goods stores, as well as online retailers, sell their own basic first aid kits. Travelers who choose to purchase a preassembled kit should review the contents of the kit carefully to ensure that it has everything needed; any necessary additional items should be added.

BOX 2-11 Sample travel health kit checklist for travelers: supplies for children

- ☐ Baby wipes
- ☐ Change mat
- ☐ Children's medicine for pain or fever
- ☐ Diapers
- ☐ Insect repellent (avoid using products containing oil of lemon eucalyptus [OLE] or para-menthane-3,8-diol [PMD] on children <3 years old)
- ☐ Medicines taken regularly at home
- ☐ Motor vehicle restraints (for example, stroller, seatbelts, or car seat)
- ☐ Rash cream
- ☐ Sterilizing equipment for baby bottles
- ☐ Sun protection
- ☐ Thermometer

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2

LAST-MINUTE TRAVELERS

Gail Rosselot

It is never too late for a pretravel consultation. Although travelers are encouraged to access pretravel care ≥1 month before departure, clinicians can provide services within days or even hours of departure. As defined by the World Health Organization, the last-minute traveler (LMT) is anyone departing for an international destination on short notice, typically ≤2 weeks. Some reports suggest LMTs comprise up to 16% of a clinic population and include business travelers, relief workers, students, travelers visiting friends and relatives, travelers who planned a trip for some time but delayed seeking pretravel care, or travelers unsuccessful at obtaining an earlier appointment. Regardless of the reason or time constraints, clinicians should offer all travelers support for their upcoming trips.

PRETRAVEL VISIT PRIORITIES

Delivering pretravel services to LMTs can be challenging. Typically, LMTs only have time for a single encounter. During the last-minute pretravel consultation, consider what risk-reduction strategies might be necessary to address the following.

Clinic availability. For last-minute appointments, telemedicine services might be an option (for more details, see Sec. 2, Ch. 16, Telemedicine).

Time until departure. Weeks? Days? Hours?

Itinerary vaccinations. What is current vaccine availability? How long before post-vaccination immunity is achieved (e.g., ≥10 days after receiving yellow fever [YF] vaccine)? What are the destination's vaccine requirements (e.g., YF or meningococcal)? What is the recommendation for vaccines requiring multiple doses?

Traveler's health status and immunizations. Does the traveler have any preexisting health problems? Do they need booster vaccinations or to complete an unfinished vaccination series?

Resources at destination. What items does the traveler need to carry with them (e.g., adequate medication supply, travel kit items, illness self-treatment options)?

Coronavirus disease 2019. What are the destination requirements for coronavirus disease 2019 (COVID-19) testing or vaccination documentation?

Vaccinations

Consider each traveler's itinerary, trip activities, risk for infection at the destination, and cumulative risk associated with repeat travel. Educate travelers about the value and safety of vaccinations; emphasize preventive behaviors for travelers who might not be adequately protected if they are vaccinated immediately before travel or who do not have sufficient time to complete a vaccine series.

ROUTINE VACCINES

Most travelers who attended school in the United States received routine vaccinations as children. For travelers who are not up to date on vaccinations, provide first or additional vaccine

doses, including influenza vaccine, according to Advisory Committee on Immunization Practices (ACIP) schedules, and arrange for return visits as needed.

RECOMMENDED VACCINES: SINGLE-DOSE PROTECTION

Even with limited time before departure, research supports the use of certain single-dose vaccines, if indicated, to initiate protection in LMTs. These include cholera for selected travelers, hepatitis A (monovalent), meningococcal (quadrivalent, ACWY), polio booster (inactivated), and typhoid (injectable) vaccines. Chapters on the respective diseases in Section 5 provide indications and dosing.

RECOMMENDED VACCINES: MULTIPLE DOSES NEEDED

LMTs often cannot complete the schedule of vaccines requiring multiple doses to induce full protection. Carefully evaluate the need for these vaccines, factoring in destination, incidence, and disease severity. If a traveler needs protection against hepatitis B, Japanese encephalitis (JE), or rabies, consider alternative approaches, including use of an approved, accelerated schedule or, depending on expected duration of stay and level of risk, identifying vaccination resources for the traveler at the destination. Travelers should be aware that vaccines received in some countries might be of substandard quality (see Sec. 6, Ch. 3, . . . *perspectives*: Avoiding Poorly Regulated Medicines & Medical Products During Travel). Because travelers' level of protection will be unclear if they do not complete a full series of multidose vaccination, provide preventive behavior counseling.

HEPATITIS B

A shortened schedule of 2 doses (at 0 and 28 days) of Heplisav-B vaccine is approved for adults ≥18 years of age. For LMTs with imminent exposure (e.g., disaster relief workers), clinicians can use an accelerated vaccination schedule with Twinrix, the combination hepatitis A and hepatitis B vaccine at 0, 7, and 21–30 days, plus a 12-month booster. Arrange a follow-up visit(s) for short-term travelers to complete the series, and help extended-stay travelers identify resources at their destination to complete the schedule.

JAPANESE ENCEPHALITIS

In the United States, the JE vaccine, IXIARO, has been approved for use with an accelerated schedule (0, 7 days). For at-risk LMTs who cannot complete the full primary vaccine series ≥1 week before travel, counsel them to strictly adhere to insect precautions. Alternatively, help travelers identify reliable sources for IXIARO vaccination at their destination, or with internationally (but not domestically) available, single-dose JE vaccines, (e.g., Imojev [Sanofi Pasteur] or live attenuated SA 14-14-2 JE vaccine [Chengdu Institute of Biological Products]).

RABIES

In the United States, rabies preexposure vaccination previously consisted of a series of 3 intramuscular injections of a rabies vaccine given on days 0, 7, and 21 or 28. The ACIP recently revised its recommendations for rabies preexposure vaccination and approved a 2-dose preexposure regimen given on days 0 and 7. This revised schedule has the advantage of being both less expensive and easier to complete prior to travel. There is, however, an absence of data on how long this 2-dose series provides protection against rabies virus exposure. As a result, travelers with a sustained risk for rabies exposure should either have a titer drawn or receive a third dose of vaccine within 3 years of the initial series.

For travelers who started, but did not complete, a rabies preexposure vaccination series and had a potential rabies exposure, provide the same postexposure prophylaxis as for a completely unimmunized person. Regardless of whether travelers are vaccinated or not, emphasize animal avoidance (see Sec. 4, Ch. 7, Zoonotic Exposures: Bites, Stings, Scratches & Other Hazards, Sec 5, Part 2, Ch. 18, Rabies, and Sec 5, Part 2, Ch. 19, . . . *perspectives*: Rabies Immunization). Encourage travelers to purchase insurance for evacuation or urgent postexposure treatment (see Sec. 6, Ch. 1, Travel Insurance, Travel Health Insurance & Medical Evacuation Insurance). As warranted, offer longer-stay travelers the option to receive the rabies vaccine series at their destination.

REQUIRED VACCINES

CORONAVIRUS DISEASE 2019

The Centers for Disease Control and Prevention (CDC) advises all eligible international travelers to be up to date with their COVID-19 vaccinations (primary series and booster[s]) before travel; see www.cdc.gov/coronavirus/2019-ncov/vaccines/stay-up-to-date.html. Travelers should also check to confirm the latest COVID-19 entry requirements at their destination.

MENINGOCOCCAL

Quadrivalent (ACWY) meningococcal vaccine is required for adults and children >2 years of age traveling to Saudi Arabia for religious pilgrimage. Hajj visas cannot be issued without proof that applicants received meningococcal conjugate vaccine ≥10 days and ≤5 years before arriving in Saudi Arabia.

YELLOW FEVER

Travelers who receive YF vaccine <10 days before entering a risk area are at risk of infection with YF virus. Documentation of vaccination against YF becomes valid 10 days after administration. When proof of vaccination against YF is required by a country on the traveler's itinerary, and the LMT is planning to arrive before 10 days have elapsed, clinicians can suggest the traveler rearrange the order of travel or reschedule the trip. Otherwise, the traveler risks being denied entry, quarantined, or revaccinated at the border. In travelers for whom YF vaccine is contraindicated, YF vaccine Uniform Stamp Owners (clinicians designated by their state or territorial health department to administer YF vaccine) can issue a medical waiver letter in lieu of vaccination. See Sec. 5, Part 2, Ch. 26, Yellow Fever, for more details.

Malaria & Other Mosquito-Borne Illnesses

Clinicians must factor in time until departure and local pharmacy supply when considering malaria chemoprophylaxis choices for LMTs, in addition to the usual considerations of cost, drug resistance at destination, itinerary, medical contraindications, and patient preference. For travelers departing in ≤2 weeks, options for malaria chemoprophylaxis include atovaquone-proguanil or doxycycline in addition to education about mosquito avoidance and follow-up for fever. Consider primaquine or tafenoquine only if time allows for glucose-6-phosphate-dehydrogenase (G6PD) screening; do not prescribe either of these drugs without first knowing the traveler's G6PD status (see Sec. 5, Part 3, Ch. 16, Malaria). Educating travelers about insect avoidance can help them to avoid Zika, dengue, and chikungunya infections at their destination and help to prevent local disease transmission (see Sec. 4, Ch. 6, Mosquitoes, Ticks & Other Arthropods).

Risk-Management Health Counseling

Pretravel counseling is critical for LMTs. Determine travelers' knowledge and experience in managing travel health risks, and focus on major risks of the trip and special issues for LMTs (see Box 2-12). LMTs benefit most when provided with simple, prioritized messages about prevention and self-care.

SPECIAL CHALLENGES

Travelers Leaving in Less Than 48 Hours

If travel is imminent, clinicians can still provide telehealth or secure digital messaging for prevention counseling and recommendations for services at the destination. During the consultation, emphasize and reassure the LMT that many travel health risks can be prevented by adhering to healthy behaviors.

Travelers with Preexisting Medical Conditions

LMTs with preexisting conditions might be at increased risk for acute episodes of comorbid conditions (see Sec. 3, Ch. 3, Travelers with Chronic Illnesses). These travelers should carry a portable medical record, know reliable sources for medical care at their destination, and purchase travel health insurance, trip insurance, and medical evacuation insurance. In addition, encourage these travelers to schedule a pretravel appointment or conversation with their treating clinician. Some conditions (e.g., immunosuppression, pregnancy), often require additional discussion or advanced planning and could warrant delaying departure (see Sec. 3, Ch. 1, Immunocompromised Travelers, and Sec. 7, Ch. 1, Pregnant Travelers).

BOX 2-12 Last-minute travelers (LMTs): supplemental counseling topics

GENERAL PREVENTION MESSAGES

For general prevention messages, see Sec. 2, Ch. 1, The Pretravel Consultation.

REASSURANCE

Address concerns that "last-minute" consultation visits are "too late."

Assure travelers that vaccinations, regardless of when they are given, have value, and protective immunity continues to develop.

Although high-risk exposures are possible on arrival to the destination, educate travelers about cumulative risk associated with repeat travel.

ONLINE RESOURCES

Inform travelers where online they can find information on destination medical services:

- US Department of State (www.travel.state.gov)
- International Society of Travel Medicine clinic directory (www.istm.org)

Provide resources for health information for international travel:

- CDC Travelers' Health (https://wwwnc.cdc.gov/travel)
- Heading Home Healthy (www.headinghomehealthy.org)
- Pre-Travel Providers' Rapid Evaluation Portal (www.gten.travel/prep/prep)

Encourage LMTs to obtain travel health and medical evacuation insurance.

TRAVEL HEALTH KITS

Educate LMTs that drugs and health kit products purchased abroad might be counterfeit or substandard.

Encourage LMTs to purchase and pack medications for travelers' diarrhea or altitude illness, over-the-counter drugs, first aid supplies, insect repellent, sunscreen, condoms, and thermometers before leaving the United States (see Sec. 2, Ch. 10, Travel Health Kits).

Inform travelers to check 24-hour pharmacies, airport clinics, and online companies offering overnight or expedited shipping to obtain needed kits or supplies.

POSTTRAVEL APPOINTMENT

Have the LMT return to the clinic after travel to complete any unfinished vaccine series.

Initiate preparation in advance of the next spur-of-the-moment travel.

Extended-Stay Travelers

A last-minute consultation will not provide adequate time for a full medical and psychological evaluation or additional education for an expatriate. Advise extended-stay travelers to arrange an early consultation with a qualified clinician at their destination.

Traveler Requests: Carrying Vaccines or Off-Label Dosing

Because of time constraints, some LMTs might ask to carry a vaccine abroad or for a vaccine to be administered off-label (e.g., different schedule, double dosing). Due to cold chain concerns, it is rarely advisable to provide travelers with a supplied vaccine. Clinicians who administer a vaccine in a nonstandard manner can face medical-legal issues and induce a false sense of protection in the traveler.

Recurring Last-Minute Travelers

Clinics that frequently see LMTs might want to address this as an administrative issue. The clinical practice could build flexibility into the schedule and proactively identify groups likely to travel last minute (e.g., college students, corporate employees, relief workers). For these travelers, the clinic might consider routine pretravel visits or preemptive vaccinations for certain itineraries.

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MENTAL HEALTH

Thomas Valk

International travel is stressful. Stressors vary to some extent with the type of travel: short-term tourist travel likely creates the least stress, whereas frequent travel, humanitarian and disaster work, and expatriation cause the most. The stressors of travel can cause preexisting psychiatric disorders to recur, latent or undiagnosed problems to become apparent, and new problems to arise. In addition, jet lag, fatigue, travel during a pandemic, and work or family pressures can trigger anxiety and aggravate depressive symptoms in short-term travelers.

OCCURRENCE OF MENTAL HEALTH PROBLEMS IN TRAVELERS

Data on the rate at which mental health problems occur in travelers are non-existent. Few data from clinical populations include a study of British diplomats, in which 11% of medical evacuations were nonphysical, or psychological in nature. In this study, among people evacuated for psychological reasons, 71% were in their 20s; the overall incidence for psychological evacuations was 0.3%, 41% of which were for depression. In a study of the US Foreign Service from 1982 through 1986, the incidence of psychiatric evacuations was 0.2%. Of these, 50% were for substance use or affective disorder, and evacuations for mania and hypomanic states accounted for 3%.

A study of psychiatric emergencies in travelers to Hawaii estimated a rate of 0.2% for tourists and 2% for transient travelers (those arriving in Hawaii with no immediate plans to leave) versus 1% for residents. The study listed diagnoses in this population, in order of decreasing frequency, as schizophrenia, alcohol abuse, anxiety reaction, and depression. Finally, researchers in a landscape analysis of travel-related psychosis generated a rough calculation of incidence rate for psychiatric hospitalization of tourists to a destination of high religious significance (Jerusalem) and noted 19.7 cases per 100,000; ≥3.5% of these were psychotic episodes without prior psychiatric history.

THE PRETRAVEL CONSULTATION & MENTAL HEALTH EVALUATION

Travel health providers should include mental health screening in any pretravel consultation. Some groups especially warrant mental health screening, including people planning extended

or frequent travel; participants in humanitarian or disaster relief work; and anyone intending to take up long-term or semipermanent residence in another country. Because travel medicine specialists rarely have mental health credentials, they should use a brief inquiry aimed at eliciting previously diagnosed psychiatric disorders. To introduce this portion of the consultation and to elicit the most cooperation, practitioners can enumerate that international travel is stressful for everyone and has been associated with the emergence or reemergence of mental health problems; the availability of culturally compatible mental health services varies widely; and laws regarding the use of illicit substances can be severe in some countries.

Ask travelers about indicators of overt or underlying mental health problems. Some areas to cover include whether the traveler previously experienced, was treated for, or was diagnosed with a psychiatric disorder, including any associated with prior travel, and the type of treatment (inpatient, outpatient, or medications) involved, if any. Also inquire about current psychiatric disorders and treatment and whether any members of their immediate family have serious mental health problems. In addition, ask travelers about current or past use of illicit substances and whether they have a formally diagnosed substance use disorder or if health care providers, friends, or family have suggested that the traveler might be using alcohol or other substances to excess.

In general, any history of inpatient treatment, psychotic episodes, violent or suicidal behavior, affective disorder (including mania, hypomania, or major depression), any treatment for substance use problems, and any current treatments warrant further evaluation by a mental health professional, preferably one experienced in handling problems related to international travel. On occasion, a patient's mental status during the pretravel consultation will be notably abnormal, which also should prompt a referral to a mental health professional for further evaluation.

CHALLENGES & BARRIERS TO HEALTHY TRAVEL

People with mental health issues might face several challenges and barriers to healthy travel. Be prepared to discuss and help the traveler manage the many of the following situations.

Contraindicated Medications

Mefloquine can cause neuropsychiatric side effects. Avoid prescribing mefloquine for malaria prophylaxis to patients with mental health issues. Please see the discussion of mefloquine in Sec. 5, Part 3, Ch. 16, Malaria.

Laboratory Monitoring of Medication Levels

For travelers who need routine laboratory testing to measure levels of lithium or other mood-stabilizing medications, clinicians should make them aware that they could face challenges in locating in-country laboratory facilities capable of this testing. Inform travelers that medication levels might fluctuate, particularly in environments with high ambient temperatures, because increased perspiration can lead to lithium toxicity, even on a consistent dose.

Medical Evacuation Insurance

Encourage travelers with mental health issues to consider purchasing international travel health and medical evacuation insurance policies that include coverage for psychiatric emergencies. Caution the traveler that many medical evacuation policies exclude psychiatric emergencies or evacuation for preexisting conditions. See Sec. 6, Ch. 1, Travel Insurance, Travel Health Insurance & Medical Evacuation Insurance, for details.

Mental Health Treatment

Long-term travelers or expatriates might have difficulty finding culturally compatible mental health treatment in the destination country. Counsel these travelers to seek assistance from a mental health professional with overseas experience.

Refilling Prescriptions

Long-term travelers and expatriates might have difficulty obtaining refills of psychotropic medications while living overseas because availability, or even legality, of these drugs varies from country to country. Travelers should check with the country's embassy or with a reputable in-country pharmacy or health care provider. As