GeoSentinel Surveillance of Illness in Returned Travelers, 2007–2011

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Background: International travel continues to increase, particularly to Asia and Africa. Clinicians are increasingly likely to be consulted for advice before travel or by ill returned travelers.

Objective: To describe typical diseases in returned travelers according to region, travel reason, and patient demographic characteristics; describe the pattern of low-frequency travel-associated diseases; and refine key messages for care before and after travel.

Design: Descriptive, using GeoSentinel records.

Setting: 53 tropical or travel disease units in 24 countries.

Patients: 42 173 ill returned travelers seen between 2007 and 2011.

Measurements: Frequencies of demographic characteristics, regions visited, and illnesses reported.

Results: Asia (32.6%) and sub-Saharan Africa (26.7%) were the most common regions where illnesses were acquired. Three quarters of travel-related illness was due to gastrointestinal (34.0%), febrile (23.3%), and dermatologic (19.5%) diseases. Only 40.5% of all ill travelers reported pretravel medical visits. The relative frequency of many diseases varied with both travel destination and reason for travel, with travelers visiting friends and relatives in their country of origin having both a disproportionately high burden of serious febrile illness and very low rates of advice before travel (18.3%). Life-threatening diseases, such as *Plasmodium falciparum* malaria, melioidosis, and African trypanosomiasis, were reported.

Limitations: Sentinel surveillance data collected by specialist clinics do not reflect healthy returning travelers or those with mild or self-limited illness. Data cannot be used to infer quantitative risk for illness.

Conclusion: Many illnesses may have been preventable with appropriate advice, chemoprophylaxis, or vaccination. Clinicians can use these 5-year GeoSentinel data to help tailor more efficient pretravel preparation strategies and evaluate possible differential diagnoses of ill returned travelers according to destination and reason for travel.

Primary Funding Source: Centers for Disease Control and Prevention.

Ann Intern Med. 2013;158:456-468. www.annals.org

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* For a list of GeoSentinel Surveillance Network members, see the **Appendix** (available at www.annals.org).

International travel has increased by 50% over the past decade, with 983 million tourist arrivals in 2011 (1). Long-distance travel, especially to countries with emerging economies in Asia and Africa, has increased disproportionately (1). Travel frequency is also increasing for persons with comorbid conditions, those traveling for business, or those visiting friends and relatives (2). Travelers visiting friends and relatives, defined as immigrants and their spouses or descendants traveling to their country or region of origin, are emerging as a group at substantial risk for travel illness (3, 4). Health practitioners are increasingly likely to be consulted by persons seeking advice before travel or who are ill after travel and should be aware of variations in the likelihood of particular familiar and unfamiliar illnesses according to traveler and itinerary characteristics (5).

GeoSentinel (www.geosentinel.org), with 53 clinical sites in 24 countries, hosts the largest available database of diseases reported in international travelers and immigrants, with more than 170 000 patient records collected since its founding in 1995 by the International Society of Travel Medicine and the Centers for Disease Control and Prevention (CDC).

We present results from analysis of the most recent GeoSentinel data (2007 to 2011), highlighting key diagnostic messages for practitioners about common and low-frequency imported diseases according to region, travel reason, and patient demographic characteristics to refine important messages for care before and after travel.

METHODS

GeoSentinel sites are specialized travel or tropical medicine clinics that have demonstrated training, experience, or significant publication in travel or tropical medicine. Sites contribute clinician-based sentinel surveillance on all patients seen during routine clinical care for a presumed travel-related illness. The 53 clinical sites are located in 24 countries (21 sites in North America, 17 in Europe, 10 in Australasia, 3 in Latin America, and 1 each in Southern Africa and the Middle East). Most sites are located in academic health centers; sites may be administratively independent or operate within broader infectious disease or community health services. Some sites provide pretravel care at the same location and some provide only outpatient care.

Anonymized patient data gathered during routine patient care are entered at each site directly into a Structured Query Language database. Standardized data collection forms capture patient demographic characteristics, detailed

recent travel itinerary, list of countries visited within 5 years, reason for recent travel, symptom-based grouping by affected organ system, and presence or absence of a reported encounter with a health care provider before travel. Final diagnoses are coded by the attending physician from a list of 522 defined GeoSentinel diagnosis codes. Diagnoses involve syndromic groupings plus specific causes where possible and syndromic groupings only where no specific cause is defined. Specific diagnoses are made using the best available laboratory tests, according to national standard clinical practice in the site country. Country or region of acquisition is based on itinerary, patterns of disease endemicity, and incubation periods and is assigned only when ascertainable.

GeoSentinel's data collection protocol was reviewed by the institutional review board officer at the National Center for Emerging and Zoonotic Infectious Diseases at the CDC and classified as public health surveillance and not as human subjects research requiring submission to institutional review boards.

This study includes travelers seen at GeoSentinel sites from 1 January 2007 to 31 December 2011. We included only travelers who presented in their country of residence after return from travel and were diagnosed with 1 or more travel-related diseases. We excluded those whose only travel was for immigration and those whose final diagnosis was considered to be unrelated to travel. Data were analyzed in Access 2010 (Microsoft, Redmond, Washington); frequencies of demographic, diagnosis, and travel-related variables were determined.

Role of Funding Source

GeoSentinel Surveillance Network is funded through a cooperative agreement with the CDC and by the International Society of Travel Medicine. GeoSentinel has an independent Data Use and Publication Committee that oversees analyses of the database from concept sheet to final manuscript and comprises 5 site directors outside of the CDC. Staff from the CDC was involved in the study design; collection, analysis, and interpretation of data; and writing of the report. The final manuscript also had CDC internal clearance.

RESULTS

There were 42 173 ill returned travelers with 49 379 diagnoses reported during the 5-year period. The largest proportion of travelers acquired their illness in Asia (32.6%), followed by sub-Saharan Africa (26.7%) and Latin America and the Caribbean (19.2%). North Africa and the Middle East; Europe; North America; and Oceania, Australia, and New Zealand accounted for the remainder (the region of illness acquisition was not ascertainable for 7.8% of patients) (**Table 1**). Overall, 40.5% of ill returned travelers reported a visit with a health professional for advice before travel, but this varied by destination region, travel reason, and diagnosis (**Table 2**).

Context

International travel is increasing, as is illness by travelers after they return home.

Contribution

Through use of a large surveillance database, frequency and patterns of illness in ill returned travelers are described. Diagnoses varied widely by destination and reason for travel. Fewer than one half of ill returned travelers had medical evaluations before travel. Illness from vaccine-preventable diseases occurred even in patients who had been evaluated before travel.

Caution

Data were obtained at specialist travel medicine sites, not routine care sites.

Implication

Diagnosis and management of the ill returned traveler are complex. Appropriate evaluation before travel may be a missed opportunity to prevent illness and death in international travelers.

—The Editors

Gastrointestinal Infections

Gastrointestinal infections were the most common illnesses reported (34.0% of all travelers) (**Table 1**). More than 40% of travelers with gastrointestinal illness had an acute diarrheal syndrome and an additional 20% and 10% had specific parasitic and bacterial causes, respectively (**Figure 1**). The most commonly diagnosed bacterial gastrointestinal infections were *Campylobacter*, *Salmonella,* and *Shigella* species; these infections were especially implicated among travelers returning from Southeast Asia, sub-Saharan Africa, the Middle East, and North Africa (**Figure 2**). The most common parasite was *Giardia*, which was proportionately most common among people who had visited South-Central Asia (India and neighboring countries). More than 40% of persons with prolonged gastrointestinal symptoms after travel (lasting >2 weeks; shown as chronic diarrhea or postinfectious irritable bowel syndrome in **Figure 1**) had postinfectious irritable bowel syndrome.

Febrile Illness

Febrile illness was reported in 23.3% of all travelers (**Table 1**). Malaria, diagnosed in 29% of those with fever and disproportionately in travelers returning from Africa, was the most common specific diagnosis, followed by dengue (15%), which was predominantly found in travelers returning from Southeast Asia and Latin America and the Caribbean (**Figure 2**). Other notable specific causes of fever included enteric fever (typhoid and paratyphoid), chikungunya fever, rickettsial diseases, viral hepatitis, leptospirosis, tuberculosis, and acute HIV (**Figure 2** and **Table 3**), with the proportional contribution varying by region. For example, enteric fever was most common after travel to

Table 1. **Characteristics of Ill Returned Travelers**

Variable	Total	Gastrointestinal Diagnoses	Febrile Illness	Dermatologic Diagnoses	Respiratory or Pharyngeal Diagnoses	Neurologic Diagnoses	GU, STI, and Gynecologic Diagnoses
Travelers, *n (%)*	42 173	14 346 (34.0)	9817 (23.3)	8227 (19.5)	4613 (10.9)	724 (1.7)	1209 (2.9)
Diagnoses, *n**	49 379	14 837	10 092	9669	4851	738	1260
Men, %†	49.9	44.5	58.9	47.8	51.7	50.6	37.2
Median age (range), *y*‡	34 (0–95)	32 (0–92)	35 (0–91)	35 (0–95)	36 (0–93)	38 (0–88)	37 (0–88)
Travel reason, %§							
Tourism	55.7	59.3	45.1	68.2	53.6	55.4	51.9
Business	13.6	14.2	14.2	9.5	17.0	12.8	13.9
Visiting friends/relatives	15.5	8.8	28.1	10.2	16.5	13.5	18.5
Missionary	11.6	13.9	8.7	8.4	9.2	13.5	13.1
Student	2.6	3.4	2.0	2.5	2.9	4.0	1.9
Region, %‖							
Australia and New Zealand	0.5	0.2	0.2	0.7	1.8	0.7	0.6
Southeast Asia	16.3	13.8	18.1	22.0	17.4	10.1	17.3
South-Central Asia	13.6	19.1	13.2	9.1	10.6	7.6	11.1
Northeast Asia	2.7	2.2	1.2	2.9	5.8	3.2	2.4
Europe	4.7	3.5	2.1	4.7	10.1	9.3	7.4
Latin America and Caribbean	19.2	20.4	14.3	27.3	14.2	23.6	15.6
Middle East and North Africa	6.1	8.7	2.5	5.6	5.2	6.5	6.1
North America	1.5	0.5	0.4	1.6	5.3	2.9	2.1
Oceania	0.8	0.7	1.0	1.2	0.9	1.4	0.5
Sub-Saharan Africa	26.7	22.5	42.6	19.5	20.6	22.3	26.9

GU = genitourinary; STI = sexually transmitted infection.
* Some travelers had >1 diagnosis. Other diagnoses (adverse events to medication or vaccine, injury or musculoskeletal problems, opthalmologic or oral conditions, and psychological problems) are not shown (7932 diagnoses).
† Data were missing in 36 cases (0.09%).
‡ Data were missing in 143 cases (0.3%).
§ Data were missing in 22 cases (0.05%), and alternate reason (military or medical tourism) accounted for 1%.
‖ Region of illness acquisition not ascertainable in 3299 cases (7.8%).

South-Central Asia, whereas spotted fever rickettsiosis was diagnosed in 6% of travelers returning from sub-Saharan Africa (notably South Africa) with a febrile illness. Even at our specialized sites, nearly 40% of travelers diagnosed with a febrile syndrome had no specific cause identified (**Figure 1**).

Dermatologic Diagnoses

Dermatologic problems were reported in 19.5% of all travelers (**Table 1**). Animal bites or scratches or insect bites or stings, skin or soft-tissue infections, and rash or itch were most common (**Figure 1**). Specific dermatologic diagnoses by region are shown in **Figure 2**. More than 12% of all specific dermatologic presentations required rabies postexposure prophylaxis, and over 8% of all skin problems were due to cutaneous larva migrans, which was especially common among travelers returning from Southeast Asia, sub-Saharan Africa, and Latin America and the Caribbean.

Respiratory Illness

Upper and lower respiratory diagnoses were reported in 10.9% of all travelers (**Table 1**). Most respiratory illnesses were due to infections with a worldwide distribution, including nonspecific upper respiratory infections, influenza or influenza-like illness, bronchitis, and pneumonia (lobar and atypical) (**Figure 1**). Influenza A, B, or H1N1 was diagnosed in 8% of travelers with a respiratory illness. There were 35 cases of legionellosis.

Other Illnesses

Specific neurologic diagnoses were uncommon (1.7% of all travelers) but included some exotic and potentially life-threatening infections (**Table 3**). There were 132 cases of meningoencephalitis identified, mostly nonspecified, with 5 due to West Nile virus infection. Fifty-one cases of ciguatera intoxication, which causes a neurologic syndrome of paresthesia, nerve palsy, and hot or cold temperature reversal that can persist for several weeks, were identified (6). GeoSentinel sites typically specialize in tropical rather than sexually transmitted infections, so genitourinary infections and sexually transmitted infections were not commonly seen (2.9%). Over 8% of travelers had other travel-related diagnoses, including adverse reactions to medication or vaccine, injury or musculoskeletal problems, opthalmologic or oral conditions, and psychological problems (not further discussed).

Vaccine-Preventable Illnesses

Vaccine-preventable diseases were reported in 737 travelers, of whom only 19.7% had a health care encounter before travel. These included 367 cases of influenza (15.8% had had a pretravel visit), 161 cases of *Salmonella enterica* serotype Typhi (pretravel visit in 26.1%), 120 cases of hepatitis A (pretravel visit in 18.3%), 3 cases of tick-borne encephalitis (no pretravel visits), 2 cases of Japanese encephalitis (1 with pretravel visit), and 84 cases of childhood vaccine-preventable diseases (33 cases of measles, 30 cases of pertussis, 11 cases of rubella, 8 cases of mumps, and 2 cases of diphtheria [pretravel visit in 28.6%]).

Low-Frequency Illnesses

Low-frequency illnesses (<20 cases), some potentially serious, were reported (**Table 3**), including visceral leishmaniasis, scrub typhus, relapsing fever, angiostrongyliasis, botulism, melioidosis, tularemia, hantavirus infection, and *Plasmodium knowlesi*. We also saw East African sleeping sickness after travel to Tanzania, Zambia, and Zimbabwe. No cases of yellow fever, Ebola virus, Lassa fever, Marburg virus, tetanus, polio, anthrax, or plague were reported, attesting to the rarity of these high-profile diseases in travelers. No cases of rabies were reported during the 5-year period; however, 2 cases were reported to GeoSentinel in 2006 and 2012 (data not shown).

Illness by Reason for Travel and Region of Acquisition

Diagnoses varied according to reason for travel. For example, although 15.5% of ill returned travelers were visiting friends and relatives, 62.1% of *P. falciparum* malaria cases occurred among these travelers (**Table 3**) and nearly 20% of these travelers presented with *P. falciparum* (**Figure 3**). Enteric fever and *Strongyloides* species infections were also diagnosed disproportionately in travelers who visited friends and relatives, cutaneous larva migrans occurred predominantly in tourists, and schistosomiasis was most common among missionaries or volunteers (**Figure 3**).

Illnesses were also reported in travelers to economically developed and temperate regions. One third of travel-related *Legionella* species infections were acquired in Europe, as were approximately 20% of measles and 15% of acute HIV cases. Europe was the destination for some travelers diagnosed with hepatitis A (8 cases), trichinellosis (7 cases), and vector-borne infections (5 visceral leishmaniasis cases, mainly from Spain, Portugal, and Greece; 18 cutaneous leishmaniasis cases, mainly from Spain, Malta, and Italy; 5 cases of spotted fever rickettsiosis from Spain, France, and Greece; and 27 cases of Lyme borreliosis, mainly from Germany and Italy). Lyme borreliosis (23 cases), coccidioidomycosis (3 cases), and babesiosis (1 case) were reported in travelers to the United States. Four travelers acquired Ross River virus in Australia.

Deaths

Overall, 28 deaths were reported, one quarter of which was due to *P. falciparum* malaria (**Table 4**).

DISCUSSION

We present data captured by a global surveillance network about travel-associated illness that reflect the changing regional travel patterns. The nature of GeoSentinel and the unique size of our traveler sample have enabled diagnostic patterns for travel illnesses to be presented by region and reason and also allow description of patterns of low-frequency travel-associated diseases that are unfamiliar to many nonspecialists. The results highlight that the overall proportion of travelers reporting a visit with a health care professional before travel (even among those traveling to perceived risky destinations, such as Sub-Saharan Africa) remains suboptimal.

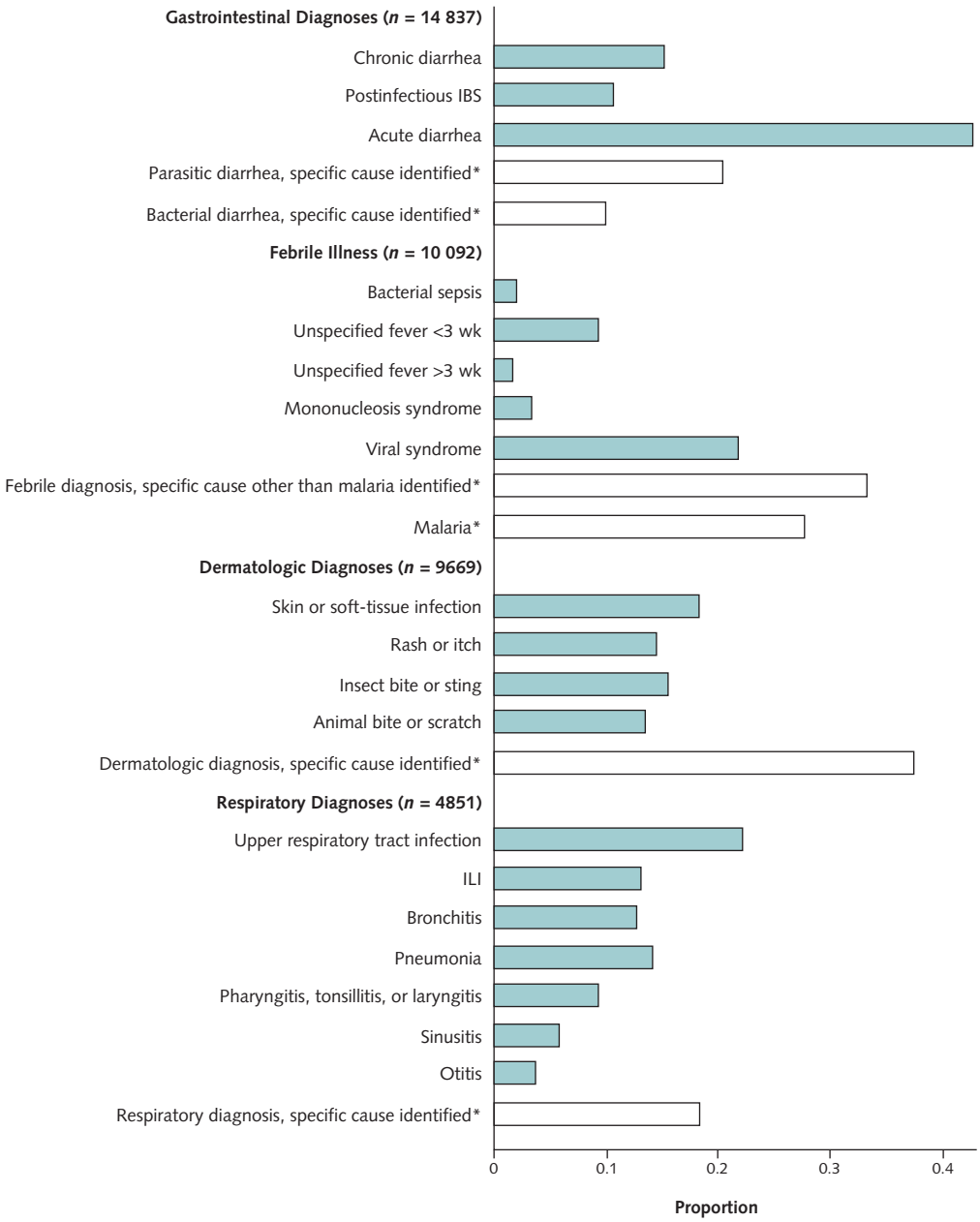
Overall, approximately 75% of illness in returned travelers is caused by gastrointestinal, febrile, and dermatologic disease (7–12). For travelers with a gastrointestinal syndrome, regional variations existed, but overall, *Campylobacter* species was the most common specific bacterial pathogen detected. Increasing quinolone resistance worldwide may have implications for the frequent use of these antibiotics for empirical therapy for acute travelers' diarrhea (13, 14). Enterotoxigenic *Escherichia coli*, the most common overall cause of acute diarrhea as defined in prospective studies (15–17), is captured by GeoSentinel as acute diar-

Table 2. **Proportion of the 42 173 Ill Returned Travelers Reporting a Pretravel Visit**

Variable	Reported Pretravel Visit, %
Total*	40.5
Region	
Sub-Saharan Africa	51.7
Asia	41.2
Oceania	39.5
Latin America and Caribbean	37.2
North Africa and Middle East	28.3
Australia and New Zealand	23.2
Europe	11.5
North America	10.9
Reason for travel	
Tourism	41.0
Business	42.7
Visiting friends/relatives	18.3
Missionary, volunteers, and researchers	59.0
Students	60.2
Other	
Military	78.2
Medical tourism	36.7
Diagnostic category	
Gastrointestinal diagnoses	46.4
Febrile illness	38.6
Dermatologic diagnoses	39.9
Respiratory and pharyngeal diagnoses	34.6
Neurologic diagnoses	36.3
GU, STI, and gynecologic diagnoses	39.4
Deaths	17.9

GU = genitourinary; STI = sexually transmitted infection.
* No pretravel visit was reported in 32.9% and was recorded as unknown in 14.8%; data were missing in 11.8%.

Figure 1. **Proportion of major syndromic groupings for gastrointestinal, febrile, dermatologic, and respiratory illnesses among ill returned travelers.**

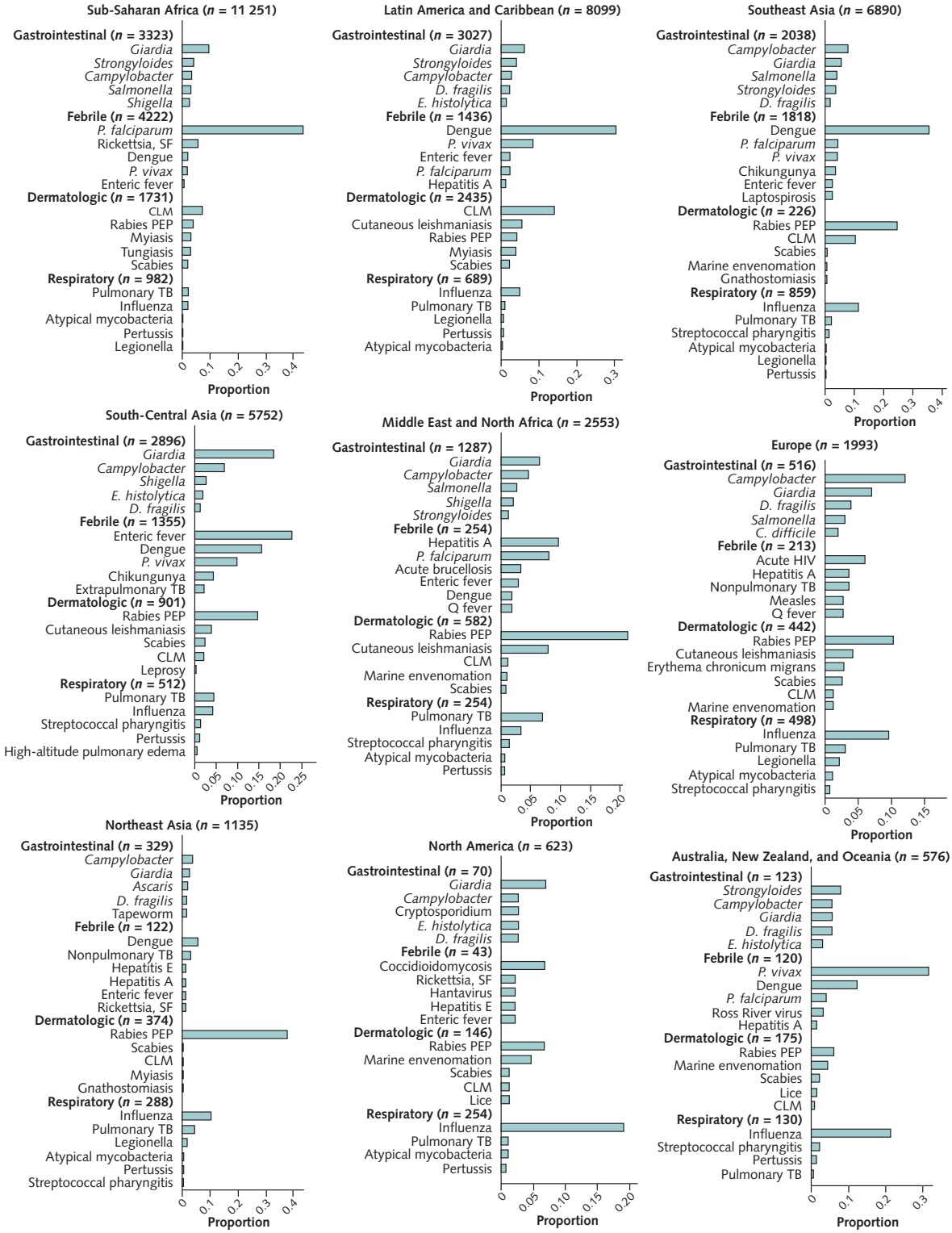


IBS = irritable bowel syndrome; ILI = influenza-like illness.
* Each bar represents a mutually exclusive classification. Green bars depict the proportion of each diagnostic category with the given syndromic grouping. White bars depict the proportion with the given specific cause, and the top diagnoses within each of these categories are shown by region in **Figure 2**.

rhea with no cause because this diagnosis requires specialized testing that is not used in routine clinical practice. Travel-related postinfectious irritable bowel syndrome, which often results in extensive investigation and several clinic visits, is an increasingly recognized but inconsistently defined entity that accounted for nearly one half of travelers presenting with nonspecific chronic diarrhea (18–21). Given the frequency and duration of gastrointestinal illness in travelers, provision of preventive advice about food- and water-borne risks is strongly recommended (22).

Plasmodium falciparum malaria remains the most clinically important febrile illness (23–28) and must be considered in all travelers returning with fever from areas with potential malaria transmission. However, whereas *P. falciparum* malaria was the most common cause of fever among travelers returning from sub-Saharan Africa, dengue was

Figure 2. **Top identified specific causes for gastrointestinal, febrile, dermatologic, and respiratory illnesses by region among ill returned travelers.**



More than 5 diagnoses are shown if >1 cause had equal numbers of cases. These graphs represent proportions, and there is variability in the number of ill travelers represented from panel to panel (shown from largest to smallest traveler numbers). CLM = cutaneous larva migrans; *D. fragilis* = *Dientamoeba fragilis*; *E. histolytica* = *Entamoeba histolytica*; *P. falciparum* = *Plasmodium falciparum*; *P. vivax* = *Plasmodium vivax*; PEP = postexposure prophylaxis; SF = spotted fever; TB = tuberculosis.

Table 3. **Notable Specific Diagnoses Among Ill Returned Travelers**

Diagnoses	Cases, *n*	Median Age, *y*	Man–Woman Ratio	Reason for Travel, %*			Reported Pretravel Visit, %	Top Countries of Exposure†
				Tourism	Visiting Friends/ Relatives	Business		
Gastrointestinal								
Giardia	1426	31	0.9	59.2	6.8	14.3	53.9	India, Thailand, Nepal, and Ghana
Campylobacter	753	29	1.2	68.5	7.2	11.7	53.3	India, Thailand, Indonesia, and Tanzania
Strongyloides	483	40	1.1	28.6	40.6	9.9	37.1	India, Vietnam, Ghana, and Dominican Republic
Salmonella enteritis	367	31	1.0	62.7	11.7	13.6	47.4	Thailand, India, Indonesia, and Egypt
Shigella	271	34	0.9	62.3	8.9	18.5	51.3	India, Egypt, Ghana, and Indonesia
Entamoeba histolytica	340	38	1.3	50.9	10.9	17.1	41.5	India, Indonesia, Mexico, and Thailand
Vibrio	9 (cholera: 2, noncholera: 7)	33	0.3	77.8	22.2	–	11.1	5 cases in Latin America (2 cases acquired in Mexico), 3 in Asia, 1 in sub-Saharan Africa
Anisakiasis	1	56	1 woman	–	–	100	100	Senegal
Shiga-toxin–producing *Escherichia coli*	1	40	1 man	100	–	–	0	Germany (May 2011)
Febrile								
Malaria	2820							
Plasmodium falciparum	1990	38	2.0	12.1	62.1	14.9	27.4	Ghana, Comoros, Nigeria, and Côte d'Ivoire
Plasmodium vivax	480	30	3.0	25.0	32.5	14.4	43.3	India, French Guyana, Myanmar, and Papua New Guinea
Plasmodium knowlesi	2	29.5	2 men	–	–	50.0	0	Both acquired in Asia (1 in Malaysia and 1 in an unspecified Asian country)
Dengue	1473	34	1.1	61.6	15.3	11.5	36.9	Thailand, Indonesia, India, and Brazil
Enteric fever	467	28	1.3	43.0	39.8	7.7	30.5	India, Nepal, Pakistan, and Bangladesh
Spotted fever rickettsia	267	48	1.3	84.2	1.5	9.0	44.6	South Africa (68.9%), Zimbabwe, Tanzania, and Swaziland
Chikungunya	164	41	0.8	53.0	21.3	17.1	29.9	India, Malaysia, Indonesia, and Thailand
Hepatitis A	120	30	1.3	48.3	32.5	10.8	18.3	India, Morocco, Egypt, and Mexico
Acute HIV	84	40	4.3	52.4	23.8	15.5	20.2	Thailand, Brazil, Guinea, and Germany
Leptospirosis	83	32	4.2	78.3	6.0	9.6	38.6	Thailand, Laos, and Costa Rica
Hepatitis E	45	38	2.0	51.1	31.1	11.1	28.9	India (40%), Pakistan, and Bangladesh
Brucellosis, acute	33	39	1.4	27.3	45.5	6.1	39.4	India, Sudan, and Iraq
Measles	33	34	2.7	54.5	24.2	12.1	24.2	India, Thailand, and France
Histoplasmosis	23	35	1.9	69.7	4.3	4.3	26.1	Guatemala and Costa Rica
Rickettsia typhi (flea-borne)	17	23	1.8	47.1	23.5	11.8	23.5	Cambodia, Malaysia, Vietnam, Indonesia, and Nepal
Visceral leishmaniasis	16	30	2.2	56.3	31.3	–	31.3	India, Greece, Portugal, and Spain
Orientia tsutsugamushi (scrub typhus)	14	38.5	2.5	71.4	14.3	14.3	21.4	Thailand and Vietnam
Rubella	11	33	4.5	54.5	27.3	18.2	9.1	Vietnam and Thailand
Melioidosis	9	37	3.5	44.4	22.2	33.3	11.1	Thailand, Singapore, and Malaysia
Mumps	8	43.5	0.6	62.5	12.5	12.5	37.5	Different country for each case (2 in Western Europe, 4 in sub-Saharan Africa, 1 in Latin America, and 1 in Asia)
African trypanosomiasis	6							
Trypanosoma brucei rhodesiense	5	49	0.7	60.0	–	20.0	20	Zambia (3 cases), Tanzania, and Zimbabwe
Trypanosoma brucei gambiense	1	20	1 woman	–			0	Burkina Faso
Relapsing fever	6	33.5	2.0	50.0	–	16.7	66.7	Senegal, South Africa, and Morocco
Ross River virus	5	32	0.7	80.0	–	20.0	0	Australia
Coccidioidomycosis	3	62	2.0	66.7	–	33.3	33.3	United States (2 cases acquired in Arizona)
Babesiosis	2	63.5	2 women	100			50.0	United States and Caribbean (country unknown)
Blastomycosis	1	31	1 man	100	–	–	0	Peru
Chagas, acute	1	26	1 woman	100	–	–	0	Mexico
Ehrlichiosis	1	32	1 woman	100	–	–	100	Unknown
Hantavirus	1	43	1 man	100	–	–	0	Canada
Paracoccidioidomycosis	1	35	1 man	–	100	–	100	Mexico
Rift Valley fever	1	21	1 woman	100	–	–	100	Kenya
Tularemia	1	57	1 man	100	–	–	0	France

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Table 3—**Continued**

Diagnoses	Cases, *n*	Median Age, *y*	Man–Woman Ratio	Reason for Travel, %*			Reported Pretravel Visit, %	Top Countries of Exposure†
				Tourism	Visiting Friends/ Relatives	Business		
Dermatologic								
Rabies PEP after bite or scratch	1249	31	1.0	68.9	17.7	7.1	25.5	Thailand, Indonesia, China, and India
Cutaneous larva migrans	806	30	0.9	80.8	2.9	5.0	42.1	Thailand, Brazil, Mexico, and Malaysia
Leishmaniasis (cutaneous or mucocutaneous)	264	23	1.9	49.6	17.0	7.2	49.6	Bolivia, Afghanistan, and Costa Rica
Myiasis	174	36	1.3	71.8	6.3	11.5	46.9	Senegal, Brazil, Costa Rica, and Belize
Tungiasis	87	30	1.1	52.9	5.7	10.3	54.0	Brazil, Madagascar, Uganda, and Ethiopia
Gnathostomiasis	12	26.1	1	50.0	8.3	8.3	33.3	Cambodia and Indonesia (92% from Asia)
Leprosy	11	44	4.5	90.9	–	9.1	18.2	Pakistan and Vietnam
Cutaneous atypical mycobacteria	6	36.5	2.0	50.0	33.3	16.7	16.7	All different (Caribbean, sub-Saharan Africa, and South-Central Asia)
Sporotrichosis	1	14	1 woman	–	100	–	0	Mexico
Yaws	1	67	1 woman	–	100	–	0	Jamaica
Respiratory or pharyngeal								
Influenza	367							
H1N1	176	16	1.2	59.7	10.2	19.9	37.5	United States, Australia, United Kingdom, and Philippines
Influenza A or B	191	36	1.1	59.7	10.5	22.0	9.1	Indonesia, Thailand, India, and China
TB	170							
MDR or XDR pulmonary TB	3	35	0.5	–	100	–	66.7	1 case each for Nigeria and India (1 case unknown)
Legionellosis	35	59	1.9	74.3	5.7	17.1	17.1	China, Italy, and Spain
Pulmonary atypical mycobacteria	35	62	0.7	54.3	28.6	11.4	8.6	China, Thailand, Kenya, South Africa, and North America
Pertussis	30	42	0.8	60.0	6.7	26.7	33.3	India and China
Diphtheria	2	20.5	1.0	–	100	–	0	Latvia
Neurologic								
Ciguatera intoxication	51	41	0.7	78.4	5.9	11.8	13.7	Bahamas and Dominican Republic
Neurocysticercosis	21	34	1.3	47.6	14.3	23.8	28.6	India
TB meningitis or tuberculoma	13	40	1.2	15.4	61.5	7.7	7.7	India and Pakistan
Scombroid, neurotoxic or paralytic shellfish poisoning	7	38	0.4	85.7	–	–	50	Mauritius (2 cases) and other (2 cases in Western Europe and 2 cases in Southeast Asia)
West Nile virus	5	53	1.5	60.0	20.0	–	0	1 case each in Afghanistan, Costa Rica, Greece, and Israel (1 unknown)
Angiostrongylus	4	25	0.3	25.0	–	–	25	1 case each in Fiji, Philippines, Jamaica, and Panama
Botulism	3	15	3 men	100			0	2 cases in Argentina and 1 in United States
Tick-borne encephalitis	3	33	2.0	66.7	33.3	–	0	1 case each from Estonia and Sweden (1 case unknown)
Japanese encephalitis	2	25.5	2 women	50.0	–	–	50	1 case each from Cambodia and Thailand
Other								
Schistosomiasis	792	32	1.4	36.1	17.6	10.2	58.7	Malawi, Uganda, Tanzania, and Ghana
Filariasis (loiasis, onchocerciasis, *Wuchereria bancrofti*, tropical pulmonary eosinophilia, and other or unknown species)	113	41	1.1	20.4	33.6	8.8	30.1	Cameroon, Gabon, Democratic Republic of Congo, and Central African Republic
Lyme disease	77	40	0.5	71.4	11.7	13.0	19.5	United States, Germany, and Italy

Continued on following page

Table 3—**Continued**

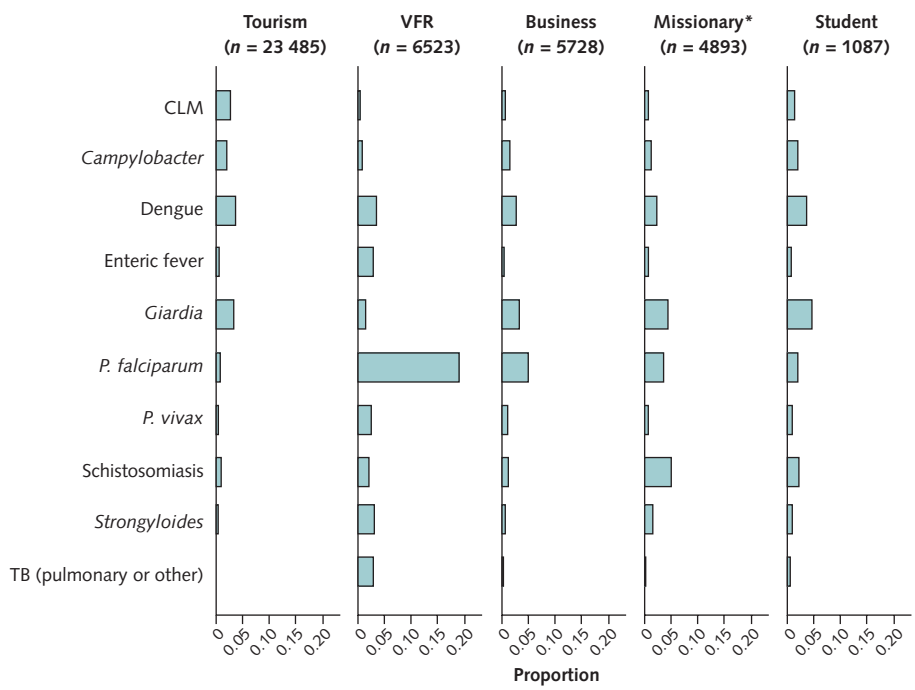
Diagnoses	Cases, *n*	Median Age, *y*	Man–Woman Ratio	Reason for Travel, %*			Reported Pretravel Visit, %	Top Countries of Exposure†
				Tourism	Visiting Friends/ Relatives	Business		
Visceral larva migrans	16	38	1	62.5	12.4	12.5	31.3	6 cases in Southeast Asia (2 cases acquired in Thailand), 5 in Latin America and the Caribbean, 3 in sub-Saharan Africa, and 2 cases unknown
Fasciola	14	43	0.6	57.1	14.3	7.1	28.6	Australia, Germany, France, and the Netherlands
Clonorchis	12	39.5	0.3	16.7	58.3	16.7	16.7	Thailand, Laos, and China
Trichinellosis	12	48	1.4	25	41.7	–	25.0	Poland and Serbia

MDR = multidrug-resistant; PEP = postexposure prophylaxis; TB = tuberculosis; XDR = extensively drug-resistant.
* Reasons for travel included tourism (55.7%), visiting friends/relatives (15.5%), and business (13.6%). Students, missionaries and volunteers, medical tourism, and military service are not shown.
† Countries reporting the most cases (or regions if countries were not specified) for each diagnosis.

more frequently the cause of fever among travelers returning from Latin America and the Caribbean and Asia (**Figure 2**). Viremic travelers can introduce dengue into new areas (29), and local transmission of dengue in such nonendemic areas as the United States (Texas and Florida) (30, 31) and Europe (32, 33) has occurred. Chikungunya virus, which can clinically resemble dengue, causes fever and occasionally intractable arthralgia and is a reemerging infection reported mainly in travelers returning from South-Central or Southeast Asia (34).

For enteric fever, management of cases is complicated by the increasing prevalence of multidrug-resistant isolates (35). Available vaccines are at best 70% effective against *S. enterica* serotype Typhi and do not adequately prevent *S. enterica* serotype Paratyphi, but nevertheless should be considered, particularly for travelers to South-Central Asia.

Figure 3. **Top 10 specific diagnoses, by main reasons for travel.**



CLM = cutaneous larva migrans; *P. falciparum* = *Plasmodium falciparum*; *P. vivax* = *Plasmodium vivax*; TB = tuberculosis; VFR = visiting friends and relatives.
* Missionary category includes missionaries, volunteers, and researchers. Traveler type was missing in 4 cases, and other reasons for travel (military or medical tourism, which are not shown) accounted for 1% of cases.

Table 4. **Demographic and Travel Characteristics of 28 Recorded Deaths Among Travelers**

Age, y	Sex	Traveler Type	Diagnosis	Region (Country)	Pretravel Visit
48	Male	Visiting friends/relatives	*Plasmodium falciparum*	Sub-Saharan Africa (Ghana)	No
66	Male	Business	*Plasmodium falciparum*	Sub-Saharan Africa (Burkina Faso)	No
57	Male	Missionary or volunteer	*Plasmodium falciparum*	Sub-Saharan Africa (Liberia)	Unknown
49	Male	Tourism	*Plasmodium falciparum*, acute renal failure	Southeast Asia (Indonesia)	No
30	Female	Business	*Plasmodium falciparum*	Sub-Saharan Africa (Equatorial Guinea)	Yes
30	Male	Business	*Plasmodium falciparum*	Unknown	Yes
53	Female	Tourism	Dengue	Southeast Asia (Thailand)	No
24	Female	Business	Dengue, *Salmonella enterica* serotype Typhi	Southeast Asia (Indonesia)	No
42	Male	Tourism	Dengue, *Orientia tsutsugamushi*, AIDS, CMV	Southeast Asia (Thailand)	Yes
59	Female	Visiting friends/relatives	*Strongyloides* hyperinfection, HTLV-1 or HTLV-2, bacterial meningitis	Caribbean (Haiti)	Unknown
57	Male	Business	Melioidosis	Southeast Asia (Thailand)	Yes
35	Male	Tourism	Melioidosis	Caribbean (Martinique)	Unknown
34	Female	Tourism	Sepsis, *Clostridium difficile* diarrhea	Caribbean (Cuba)	Unknown
55	Male	Tourism	Acute *Salmonella* diarrhea, sepsis	Caribbean (Puerto Rico)	Unknown
26	Female	Student	Influenza A, myocarditis	Northeast Asia (Taiwan)	Unknown
84	Female	Tourism	Lobar pneumonia, ARDS, sepsis	Western Europe (Spain)	No
82	Male	Business	Lobar pneumonia	South-Central Asia (India)	No
86	Male	Tourism	Lobar pneumonia, COPD, Parkinson disease	Western Europe (Spain)	Unknown
53	Male	Business	Atypical pneumonia, AIDS	Southeast Asia (Vietnam)	No
40	Male	Tourism	AIDS, pleural effusion, cancer	Southeast Asia (country not ascertainable)	No
49	Female	Tourism	Lobar pneumonia, acute renal failure	Middle East (Saudi Arabia)	Yes
65	Male	Tourism	Legionnaire disease, acute renal failure	Eastern Europe (Prague)	Unknown
83	Male	Tourism	Sepsis, atypical pneumonia	Northeast Asia (China)	No
35	Male	Tourism	Endocarditis	Northeast Asia (China)	Unknown
78	Female	Tourism	Acute urinary tract infection, sepsis	Western Europe (Spain)	No
67	Male	Tourism	Pyelonephritis, sepsis	Western Europe (Spain)	No
5	Female	Tourism	Sepsis, hematologic cancer	South-Central Asia (India)	No
29	Female	Tourism	Encephalitis (unknown cause)	Southeast Asia (country not ascertainable)	Unknown

ARDS = acute respiratory distress syndrome; CMV = cytomegalovirus; COPD = chronic obstructive pulmonary disease; HTLV = human T-lymphotropic virus.

Other clinically important causes of fever include acute HIV, acute hepatitis A and E, and leptospirosis. Among travelers returning from sub-Saharan Africa with a febrile illness, spotted fever rickettsiosis due to *Rickettsia africae* was a common cause, highlighting that a complete physical examination is needed to detect a necrotic eschar at the site of the tick bite (36). Fever with or without rash occurring soon after a safari trip to East Africa should lead to a prompt blood film for *Trypanosoma brucei rhodesiense* to facilitate rapid diagnosis and reduce the risks for neuroinvasion and death (37, 38). Early referral of severely ill returned travelers to a clinician experienced in travel and tropical medicine may help mitigate the potential severe sequelae of these infections.

The profile of dermatologic problems is similar to that described in other studies (5, 7, 39–44). Clinicians should be educated to recognize the pathognomonic serpiginous lesions of hookworm-related cutaneous larva migrans, which respond to therapy with ivermectin or albendazole (45). Animal bites or scratches (mainly from dogs or monkeys) requiring rabies postexposure prophylaxis were common, especially in tourists returning from Asia. Indonesia has been identified as a particular area of recent risk (46). Leishmaniasis, transmitted by sandflies in many tropical countries and southern Europe, was the most frequent cause of cutaneous ulcer in our study (47). The lesions are typically painless with a clean base and rolled-up edges surrounding the crater, and misdiagnosis is common.

Although the largest proportion of ill travelers had returned from Asia, Africa, or Latin America, our data highlight important illness encountered in travelers to developed countries in Europe; North America; and Australia, New Zealand, and Oceania. Vector-borne diseases in travelers to Europe, which mirror an overall increase in arthropod-borne diseases in Europe (48), are particularly notable, as are the cases of measles (49) and legionellosis (50). Travelers to western countries often consider their risk for disease to be low, as do health care professionals.

In addition to low proportions of travelers reporting a visit with a health care professional before travel, our data suggest that outcomes can be suboptimal, with vaccine-preventable diseases occurring even among those who reported a pretravel visit. For example, nearly 20% of travel-related hepatitis A infections occurred in patients with a pretravel encounter before travel. Because even a single dose of hepatitis A vaccine provides nearly 100% protection against infection (51), this may indicate a gap in staff knowledge or patient acceptance of recommendations. Influenza, the most common illness among those who had received advice before travel, is transmitted year-round in the tropics, October to March in the northern hemisphere, and May to September in the temperate southern hemi-

sphere. Our data support current CDC recommendations to consider vaccination if traveling to a region where influenza transmission is occurring (52, 53). Cases of childhood vaccine-preventable diseases emphasize the importance of updating routine immunizations before travel according to national or international travel health guidelines (54–56). For non–vaccine-preventable diseases, the pretravel visit offers the opportunity for relevant education. For example, optimal personal protective measures against arthropod bites may help prevent vector-borne diseases. Such measures include skin repellents containing DEET (diethyltoluamide) or picaridin; permethrin-impregnated clothing (57); and for the night-biting vectors of *Anopheles* malaria, bed nets and screened or air-conditioned sleeping quarters (58).

The disproportionate burden of serious febrile illnesses, such as malaria and enteric fever, among travelers who visited friends and relatives juxtaposed with the low rates of advice before travel in this population represents a health disparity, highlighting the need for more effective delivery of preventive advice to this high-risk group (3, 4, 59, 60). Travelers who visited friends and relatives often adopt local health-related behaviors during their trip, and some who have emigrated from resource-poor countries may not have had routine vaccinations (61). Aversion to consultation and intervention costs as well as inadequate appreciation of potential travel risks are common obstacles to seeking preventive care. Proactive strategies by primary care clinicians are needed, such as routinely questioning immigrant patients about future travel plans and advising them of the importance of seeking care before travel when they visit for other reasons (62). Along with acute illnesses associated with recent travel, tuberculosis, strongyloidiasis, schistosomiasis, filariasis, cysticercosis, and leprosy were also commonly diagnosed in travelers who visited friends and relatives. These conditions may have been unrelated to their clinical presentation and instead may have been acquired before their initial immigration, highlighting the importance of a full risk assessment that goes beyond the most recent trip, especially in this traveler group.

Risk for death related to travel cannot be calculated from GeoSentinel, but our data show a sample of deaths after return from travel that were reported to clinics specializing in management of travel or tropical diseases. Deaths during travel have been examined in other studies, with trauma, chronic diseases, injuries, suicide, and homicide described as predominant causes. Although infections have generally accounted for only 1% to 2% of deaths in some other reports (63–67), *P. falciparum* malaria, dengue, and respiratory agents were the most common underlying causes of the 28 deaths in our study. Most nontropical causes of death affected travelers who were older or had comorbid conditions, such as cancer or AIDS; 5 of these occurred after travel within Europe. Two deaths, 1 from Thailand and 1 from Martinique, were due to melioidosis, a frequently fatal septic illness caused by *Burkholderia pseudomallei*. This environmental gram-negative bacterium, found in soil and surface water, is being recognized increasingly outside its traditional foci in Asia and northern Australia (68). Seven additional cases from Thailand, Singapore, and Malaysia were reported (**Table 3**). One quarter of deaths, but only 13.6% of all illnesses, occurred in business travelers, suggesting that employers should consider their potential liability if a consultation before travel is not provided.

The reported cases represent sentinel surveillance data among ill returned travelers visiting specialist clinics and do not reflect the experience of healthy travelers or those with mild or self-limited illness visiting primary care practices or other health care sites. In addition, there is some heterogeneity of referral patterns, patient populations, and travel demographic characteristics between GeoSentinel sites. The GeoSentinel surveillance form was designed primarily to tie diagnosis to exposure place and travel reason; detailed clinical information, such as comorbid conditions, physical findings, general laboratory or imaging data, treatment, or clinical course (except death), are not captured. We also cannot differentiate travelers who received a diagnosis related to screening tests done for demographic or itinerary-based considerations rather than one related to their presenting symptoms. The study design does not permit determination of absolute or relative risks. Nevertheless, our results show the relative frequency and range of illnesses seen in travelers.

In conclusion, this analysis will assist clinicians in framing potential differential diagnoses for ill returned travelers to facilitate either appropriate management plans or early referral for those who are seriously ill. Our results can also help clinicians and public health policymakers to think strategically about appropriate investment of time and resources during pretravel visits (54–56).

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Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Acknowledgment: The authors thank Elena Axelrod, Charles Miller, Kathy Smith, and the staff at each GeoSentinel site for data, programming, and administrative support; Surendra Karki, MD, for his assistance with the graphics; and Adam Plier for invaluable skills in network coordination and editorial support.

Grant Support: The GeoSentinel Surveillance Network is funded through a cooperative agreement with the Centers for Disease Control and Prevention (grant 5U50CI000359) and with funding from the International Society of Travel Medicine.

Potential Conflicts of Interest: Disclosures can be viewed at www.acponline.org/authors/icmje/ConflictOfInterestForms.do?msNum=M12-1036.

Reproducible Research Statement: *Study protocol and statistical code:* Available from Dr. Freedman (e-mail, freedman@uab.edu). *Data set:* Not available.

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Appendix: The GeoSentinel Surveillance Network

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