

# Illness in Travelers Visiting Friends and Relatives: A Review of the GeoSentinel Surveillance Network

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**Travelers returning to their country of origin to visit friends and relatives (VFRs) have increased risk of travel-related health problems. We examined GeoSentinel data to compare travel characteristics and illnesses acquired by 3 groups of travelers to low-income countries: VFRs who had originally been immigrants (immigrant VFRs), VFRs who had not originally been immigrants (traveler VFRs), and tourist travelers. Immigrant VFRs were predominantly male, had a higher mean age, and disproportionately required treatment as inpatients. Only 16% of immigrant VFRs sought pretravel medical advice. Proportionately more immigrant VFRs visited sub-Saharan Africa and traveled for >30 days, whereas tourist travelers more often traveled to Asia. Systemic febrile illnesses (including malaria), nondiarrheal intestinal parasitic infections, respiratory syndromes, tuberculosis, and sexually transmitted diseases were more commonly diagnosed among immigrant VFRs, whereas acute diarrhea was comparatively less frequent. Immigrant VFRs and traveler VFRs had different demographic characteristics and types of travel-related illnesses. A greater proportion of immigrant VFRs presented with serious, potentially preventable travel-related illnesses than did tourist travelers.**

An estimated 150 million people live outside of the country of their birth [1], and each year, increasing numbers of people migrate from developing countries to developed countries. As many as 50 million people travel each year from industrialized nations to tropical or subtropical destinations [2], and persons visiting friends and relatives comprise 25%–40% of these travelers [2–8].

Travelers returning to their country of origin to visit friends and relatives (VFRs) have an increased risk of travel-related health problems [9–12]. Reports suggest that their risk of acquiring infections, such as malaria [1, 13–15] and influenza

[16], is increased several-fold, compared with the risk of tourists, expatriates, or other groups of travelers. The elevated risk is related to a number of factors, including higher risks of exposure and insufficient protection measures. These individuals are less likely to seek pretravel health advice or to be adequately vaccinated [5, 13] and are more likely to stay in remote rural areas [9, 17], have close contact with local populations [18], consume high-risk foods and beverages [19], travel at the last minute, and have longer trip durations [20]. Although the increased risks of returning with specific illnesses have been studied, no large study has compared VFRs with other travelers across a broad spectrum of travel-related illnesses and destinations.

Theoretically, the term “VFR” could mean any person who travels to visit friends and family abroad. However, it is generally accepted that the term specifically refers to immigrants who are ethnically and/or racially distinct from the majority population of their country of residence and who return to their homeland to visit friends and/or relatives [21]. It also describes people who are traveling from the higher-income country of their residence to their country of origin (typically,

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a low-income country). Even this group is not homogeneous; it may also include children of foreign-born parents—that is, “second-generation” immigrants whose family originated in the country being visited. The risks of travel may differ between these groups, and many previous studies have not specified exact criteria used to define a VFR.

GeoSentinel, a global sentinel surveillance network established in 1995 through the International Society for Travel Medicine and the Centers for Disease Control and Prevention [22], provides a means of examining health problems that occur among travelers and immigrants. The specific objectives of this study were to carefully define 2 different types of VFRs and to examine GeoSentinel data for characteristics of the 2 groups to determine whether different definitions for VFRs affect reported demographic characteristics, travel features, or illnesses acquired. Both groups of VFRs have also been compared with tourist travelers.

## METHODS

**Data collection.** Data entered into the GeoSentinel database from November 1997 through December 2004 were examined. To be included in the GeoSentinel database, patients must have sought medical advice for an illness presumed to be travel related. Data collected include demographic characteristics (age, sex, country of birth, country of residence, and current country of citizenship), travel history, clinical symptoms, and diagnostic information. Travel history includes countries visited in the last 5 years. Clinicians recorded the patient’s classification (defined as immigrant/refugee, foreign visitor, expatriate, student, military personnel, or traveler), reason for most recent travel (immigration, tourism, business, research or education, missionary or volunteer, or visiting friends and/or relatives), major reasons for seeking medical care, inpatient or outpatient status, whether pretravel medical advice was sought, and the likely geographic location of the patient’s exposure. Final diagnoses reported by physicians were used to assign diagnostic codes from a standardized list of >500 diagnoses, which were also categorized into 21 broad syndrome groups. Physicians from all affiliated health care sites used the best reference diagnostics available in their country. Anonymous patient information was entered into a Structured Query Language database.

**Definitions of regions.** Individual countries were assigned 1 of the following 15 regional classifications: North America/Canada, Central America, South America, the Caribbean, Eastern Europe, Western Europe, Oceania, Australasia, south central Asia, Southeast Asia, east and north Asia, west Asia (including the Middle East), North Africa, sub-Saharan Africa, and Antarctica. On the basis of the economic classifications of the World Bank (Washington, D.C.) [23], countries were as-

signed to 1 of 2 groups: either high-income country or any other country (henceforth referred to as low-income country).

**Diagnostic categories.** Only persons who received probable or confirmed diagnoses were included in the study. The diagnoses included in the broad syndrome groups (systemic febrile illness, acute diarrhea, chronic diarrhea, respiratory syndrome, and dermatological condition) have been described elsewhere [24]. Systemic febrile illness included malaria, typhoid fever (infection with *Salmonella enterica* serotype Typhi), and dengue fever. Malaria was confirmed by thick and thin blood film examinations, immunochromatography test, or PCR. Tuberculosis was defined as either presumptive or culture- and/or PCR-confirmed active *Mycobacterium tuberculosis* infection, but this definition excluded individuals who had only positive tuberculin skin test results. Influenzavirus infection included type A, type B, or unspecified type. Nondiarrheal intestinal parasitic infection included infection with intestinal nematodes, trematodes, or tapeworm (i.e., ascariasis, clonorchiasis, enterobiasis, strongyloidiasis, and trichuriasis, and infection with *Fasciola* species, hookworm, or tapeworm), as well as any unspecified parasitic infection not causing diarrhea. Sexually transmitted disease (STD) included AIDS, HIV infection, syphilis, gonorrhea, or urethritis.

**Data entry criteria.** Three groups were included in our analysis. The first group was composed of patients reporting to GeoSentinel-affiliated clinics who were born in low-income countries and living in high-income countries who traveled to their region of birth to visit friends and relatives. Members of this group are referred to as immigrant VFRs. The second group was patients reporting to GeoSentinel-affiliated clinics who were born and live in high-income countries who traveled to low-income countries to visit friends and relatives. This group’s members are referred to as traveler VFRs. Individuals who traveled to visit friends or relatives but who traveled to high income countries only or to multiple regions, as well as travelers from low-income countries who traveled somewhere other than to their region of birth, were not classified among either VFR subgroup and were excluded from analyses. The third comparison group consisted of people who were born and living in high-income countries who traveled, as tourists, to low-income countries. These individuals are referred to as tourist travelers.

**Statistical analysis.** We analyzed the proportion of patients in each group with a specific demographic characteristic or diagnosis. Data were analyzed using SPSS software, version 11.0 (SPSS). Statistical significance for crude analysis of dichotomous variables was determined using  $\chi^2$  tests, and *t* tests were used for comparison of means. Multivariate analysis with logistic regression was used to adjust data for factors significant

on univariate testing. A 2-tailed *P* value of  $\leq .05$  was considered to be statistically significant.

## RESULTS

In the GeoSentinel database from November 1997 through December 2004, data were recorded for 1813 individuals who met the classification criteria for immigrant VFRs and for 670 who met the classification criteria for traveler VFRs. The comparison group of tourist travelers comprised 10,021 patients.

Demographic data, destination, and duration of travel of the immigrant VFR, traveler VFR, and tourist traveler groups are compared in table 1. Immigrant VFRs were predominately male (1086 [60%] of 1813 persons), had a higher mean age (38.7 years), and disproportionately required treatment as inpatients, compared with traveler VFRs and tourist travelers. For traveler VFRs, 142 (21%) of 670 were  $<16$  years old, compared with 44 (2%) of 1813 immigrant VFRs. A much smaller proportion of immigrant VFRs (284 [16%] of 1813) sought pretravel health advice, compared with traveler VFRs (316 [47%] of 670) and tourist travelers (6195 [62%] of 10,021). For immigrant VFRs, the time period between arriving in the country after immigration and presentation to a GeoSentinel clinic was highly variable, although 76% (1260 of 1657) had immigrated  $>4$  years previously (median time, 9.7 years). On the basis of available data, we determined that 54% of the immigrant VFR group

(686 of 1273) presented to a GeoSentinel clinic within 3 weeks of their most recent trip, and another 23% (293 of 1273) presented within 2 months. The corresponding proportions for the traveler VFR group were 59% (360 of 612) and 23% (139 of 612), and for the tourist traveler group, the proportions were 62% (5622 of 9124) and 19% (1740 of 9124) ( $P < .001$ ).

The main travel destinations were sub-Saharan Africa (most commonly, Kenya, Ghana, South Africa, Tanzania, and Nigeria), Asia (predominantly, India, Thailand, Indonesia, the Philippines, and Vietnam), and Latin America (most frequently, Mexico, Brazil, Dominican Republic, Peru, and Cuba). Immigrant VFRs were significantly more likely to have traveled to sub-Saharan Africa (848 [47%] of 1813 persons) than traveler VFRs (250 [37%] of 670) or tourist travelers (2062 [21%] of 10,021), whereas tourist travelers were more likely to have visited Asia. A greater proportion of immigrant VFRs took trips lasting  $>30$  days ( $P < .05$ ) (table 1).

**Demographic characteristics and diagnoses, according to region of travel.** Because the 3 groups of travelers visited different regions, we stratified data by destination to examine the characteristics and diagnoses among the groups. (tables 2–4). Regardless of destination, the proportion of immigrant VFRs who received pretravel medical advice was less than half that of traveler VFRs and approximately one-quarter that of tourist travelers. Also irrespective of destination, immigrant

**Table 1. Comparison of the characteristics of travelers who visit friends and relatives (immigrant VFRs and tourist VFRs) and tourist travelers.**

Characteristic	Immigrant VFRs (n = 1813)	Traveler VFRs (n = 670)	Tourist travelers (n = 10,021)	<i>P</i>
<b>Demographic characteristics</b>				
Male sex	1086 (60)	297 (44)	4811 (48)	$<.001^{a,b}; .07^c$
Age, mean years (range)	38.7 (2–89)	32.0 (1–85)	35.4 (1–91)	$<.001^{a,b,c}$
Sought pretravel medical advice	284 (16)	316 (47)	6195 (62)	$<.001^{a,b,c}$
Required inpatient treatment	585 (32)	71 (11)	631 (6)	$<.001^{a,b,c}$
<b>Destination</b>				
Sub-Saharan Africa	848 (47)	250 (37)	2062 (21)	$<.001^{a,b,c}$
Asia <sup>e</sup>	485 (27)	196 (29)	4615 (46)	$.2^a; <.001^{b,c}$
Latin America <sup>f</sup>	336 (19)	166 (25)	2581 (26)	$\leq .001^{a,b}; .6^c$
Other <sup>g</sup>	143 (8)	58 (9)	721 (7)	$\geq .2^{a,b,c}$
<b>Travel duration</b>				
No. of days, mean (median)	58 (31)	68 (28)	53 (21)	$.05^d$
Travel $>30$ days	760 (42)	247 (37)	3389 (34)	$<.05^{a,b}; .2^c$
Presentation within 3 weeks of return, %	54	59	62	$<.001^d$

**NOTE.** Data are no. (%) of patients, unless otherwise indicated.

<sup>a</sup> Immigrant VFRs versus traveler VFRs.

<sup>b</sup> Immigrant VFRs versus tourist travelers.

<sup>c</sup> Traveler VFRs versus tourist travelers.

<sup>d</sup> By test for trend.

<sup>e</sup> Includes Southeast Asia, south central Asia, west Asia, and east and north Asia.

<sup>f</sup> Includes Central America, South America, and the Caribbean.

<sup>g</sup> Includes North Africa, Eastern Europe, and Oceania.

**Table 2. Comparison of demographic characteristics of and diagnoses received by travelers to sub-Saharan Africa.**

Value	Immigrant VFRs (n = 848)	Traveler VFRs (n = 250)	Tourist travelers (n = 2062)	P	OR (95% CI)	
					Immigrant VFRs vs. traveler VFRs	Immigrant VFRs vs. tourist travelers
<b>Demographic characteristic</b>						
Male sex	582 (69)	93 (37)	1002 (49)	<.001 <sup>a,b,c</sup>	3.8 (2.8–5.0)	2.3 (2.0–2.8)
Age, mean years (range)	36.8 (2–70)	31.4 (1–80)	36.4 (1–85)	<.001 <sup>a,c</sup> ; .4 <sup>b</sup>	...	...
Sought pretravel medical advice	179 (21)	144 (58)	1466 (71)	≤.001 <sup>a,b,c</sup>	0.2 (0.1–0.3)	0.09 (0.07–0.1)
Required inpatient treatment	360 (42)	45 (18)	164 (8)	<.001 <sup>a,b,c</sup>	3.5 (2.4–4.9)	8.7 (7.0–10.7)
Travel duration >30 days	436 (51)	102 (41)	646 (31)	≤.004 <sup>a,b,c</sup>	1.6 (1.2–2.1)	2.3 (2.0–2.8)
<b>Diagnosis</b>						
Systemic febrile illness	439 (52)	73 (29)	375 (18)	<.001 <sup>a,b,c</sup>	2.6 (1.9–3.5)	4.8 (4.0–5.7)
Malaria	384 (45)	60 (24)	188 (9)	<.001 <sup>a,b,c</sup>	2.6 (1.9–3.6)	8.3 (6.8–10.1)
Acute diarrhea	39 (5)	23 (9)	275 (13)	≤.006 <sup>a,b</sup> ; .7 <sup>c</sup>	0.5 (0.3–0.8)	0.3 (0.2–0.4)
Chronic diarrhea	6 (0.7)	2 (0.8)	80 (4)	≤.01 <sup>b,c</sup> ; .9 <sup>a</sup>	0.9 (0.2–4.4)	0.2 (0.08–0.4)
Respiratory syndrome	51 (6)	14 (6)	80 (4)	.01 <sup>b</sup> ; ≥.2 <sup>a,c</sup>	1.1 (0.6–2.0)	1.6 (1.1–2.3)
Nondiarrheal intestinal parasitic infection	33 (4)	3 (1)	22 (1)	≤.04 <sup>a,b</sup> ; .8 <sup>c</sup>	3.3 (1.0–11.0)	3.8 (2.2–6.5)
Dermatological condition	47 (5.5)	32 (13)	252 (12)	<.001 <sup>a,b</sup> ; .8 <sup>c</sup>	0.4 (0.2–0.6)	0.4 (0.3–0.6)

**NOTE.** Data are no. (%) of patients, unless otherwise indicated. Only diagnoses that were received by >1 person in each group are shown. Regarding those who traveled to North Africa, Eastern Europe, or Oceania who received specific diagnoses, the numbers of people were too small to reach statistical significance (data not shown). VFR, traveler who visits friends and relatives.

<sup>a</sup> Immigrant VFRs versus traveler VFRs.

<sup>b</sup> Immigrant VFRs versus tourist travelers.

<sup>c</sup> Traveler VFRs versus tourist travelers.

VFRs were significantly more likely to be admitted to the hospital than the people in the other groups. Immigrant VFRs were also more likely to travel for ≥30 days in sub-Saharan Africa only.

Immigrant VFRs who traveled to sub-Saharan Africa had more than twice the odds of receiving a diagnosis of malaria than did traveler VFRs and >8 times the odds than did tourist travelers who visited this region (table 2). Immigrant VFRs also had more than twice the odds of receiving a diagnosis of malaria, compared with tourist travelers, after travel to Asia and >3 times the odds after travel to Latin America (tables 3 and 4).

The proportion of immigrant VFRs who had acute or chronic diarrhea was about one-third that of tourist travelers following travel to sub-Saharan Africa and about half that of tourist travelers after travel to Asia or Latin America. Conversely, nondiarrheal intestinal parasitic infection was found to be significantly more common among immigrant VFRs than it was among other groups (regardless of destination). For travelers to sub-Saharan Africa or Latin America, immigrant VFRs had one-third to half the odds of being diagnosed with a dermatological condition than did traveler VFRs or tourist travelers. Group differences for each region were less marked for respiratory infections (tables 2–4).

**Adjusted analyses for diagnoses among groups.** The diagnoses received among the immigrant VFR, traveler VFR, and tourist traveler groups, after adjustment for sex, age, receipt of

pretravel medical advice, travel destination, and travel duration, are compared in figure 1.

Immigrant VFRs had approximately twice the odds of receiving a diagnosis of systemic febrile illness, compared with traveler VFRs (OR, 2.0; 95% CI, 1.6–2.6) and tourist travelers (OR, 2.8; 95% CI, 2.4–3.2). They also had twice the odds of receiving a diagnosis of malaria than did traveler VFRs (OR, 2.0; 95% CI, 1.4–2.8) and 4.5 times the odds than did tourist travelers (OR, 4.5; 95% CI, 3.7–5.5). Of the patients in each group with malaria, *falciparum* malaria accounted for 86.8% of illness in the immigrant VFR group, 63.3% in the traveler VFR group, and 44% in the tourist traveler group. Compared with tourist travelers, immigrant VFRs had 7 times the odds of receiving a diagnosis of typhoid fever (OR, 7.0; 95% CI, 3.6–13.4). There were no statistically significant differences in the proportion of each group with dengue fever.

Approximately twice the proportion of tourist travelers and traveler VFRs received diagnoses of acute diarrheal illness, compared with immigrant VFRs. Chronic diarrhea was also more common among tourist travelers. In contrast, nondiarrheal intestinal parasitic infections were found to be significantly more common among immigrant VFRs.

The odds of having a respiratory illness were ~1.5 times greater for immigrant VFRs than they were for tourist travelers (OR, 1.7; 95% CI, 1.3–2.1), and the odds of influenza were almost 6 times greater (OR, 5.6; 95% CI, 2.0–15.7). Tuberculosis

**Table 3. Comparison of demographic characteristics of and diagnoses received by travelers to Asia.**

Value	Immigrant VFR (n = 485)	Traveler VFR (n = 196)	Tourist travelers (n = 4615)	P	OR (95% CI)	
					Immigrant VFRs vs. traveler VFRs	Immigrant VFRs vs. tourist travelers
<b>Demographic characteristic</b>						
Male sex	258 (53)	100 (51)	2231 (48)	.05 <sup>b</sup> ; ≥.4 <sup>a,c</sup>	1.1 (0.8–1.5)	1.2 (1.0–1.5)
Age, mean years (range)	39.3 (2–89)	33.0 (1–85)	34.8 (1–91)	≤.001 <sup>a,b</sup> ; .2 <sup>c</sup>		
Sought pretravel medical advice	72 (15)	88 (45)	3065 (66)	≤.001 <sup>a,b,c</sup>	0.2 (0.1–0.3)	0.07 (0.05–0.09)
Required inpatient treatment	117 (24)	9 (5)	288 (6)	≤.001 <sup>a,b</sup> ; >.4 <sup>c</sup>	6.9 (3.3–13.5)	4.8 (3.8–6.2)
Travel duration >30 days	177 (36)	70 (36)	1897 (41)	>.1, <sup>a,b,c</sup>	1.1 (0.8–1.5)	0.9 (0.7–1.0)
<b>Diagnosis</b>						
Systemic febrile illness	113 (23)	24 (12)	551 (12)	≤.001 <sup>a,b</sup> ; >.8 <sup>c</sup>	2.2 (1.4–3.5)	2.2 (1.8–2.8)
Malaria	17 (4)	4 (2)	63 (1)	<.001 <sup>b</sup> ; >.3 <sup>a,c</sup>	1.7 (0.6–5.2)	2.6 (1.5–4.5)
Acute diarrhea	49 (10)	36 (18)	958 (21)	≤.003 <sup>a,b</sup> ; >.4 <sup>c</sup>	0.5 (0.3–0.8)	0.4 (0.3–0.6)
Chronic diarrhea	17 (4)	4 (2)	253 (6)	≥.06 <sup>a,b</sup> ; .04 <sup>c</sup>	1.7 (0.6–5.2)	0.6 (0.4–1.0)
Respiratory syndrome	47 (10)	11 (6)	294 (6)	≤.005 <sup>b</sup> ; >.08 <sup>a,c</sup>	1.8 (0.9–3.6)	1.6 (1.1–2.2)
Nondiarrheal intestinal parasitic infection	40 (8)	2 (1)	60 (1)	<.001 <sup>a,b</sup> ; .7 <sup>c</sup>	8.7 (2.1–37)	6.8 (4.5–10.3)
Dermatological condition	55 (11)	33 (16)	641 (14)	>.05 <sup>a,b,c</sup>	0.6 (0.4–1.0)	0.8 (0.6–1.1)

**NOTE.** Data are no. (%) of patients, unless otherwise indicated. Only diagnoses that were received by >1 person in each group are shown. Regarding those who traveled to North Africa, Eastern Europe, or Oceania who received specific diagnoses, the numbers of people were too small to reach statistical significance (data not shown). VFR, traveler who visits friends and relatives.

<sup>a</sup> Immigrant VFRs versus traveler VFRs.

<sup>b</sup> Immigrant VFRs versus tourist travelers.

<sup>c</sup> Traveler VFRs versus tourist travelers.

was 16 times more common among immigrant VFRs than it was among traveler VFRs (OR, 16.7; 95% CI, 4.0–70) and >60 times more common than it was among tourist travelers (OR, 66.7; 95% CI, 28–159). STDs were also seen in a significantly greater proportion of immigrant VFRs. In contrast, dermatological conditions were diagnosed approximately half as often in immigrant VFRs, compared with other groups.

## DISCUSSION

We analyzed GeoSentinel data to examine travel characteristics and illnesses acquired by individuals visiting friends and relatives, and we made comparisons with tourist travelers. Compared with previous studies, we have been more specific in defining the term “VFR” as those traveling from a high-income to a low-income country for the purpose of visiting friends and relatives. In addition, we have separated this group into immigrant VFRs, who were born in a low-income country but are living in a high-income country, and traveler VFRs, who were born and live in a high-income country. We believe that many of the traveler VFRs are second-generation immigrants or children of immigrant VFRs, as suggested by the high proportion of children in the traveler VFR group. However, some misclassification of high- and low-income regions and of individuals in the 2 groups of VFRs is possible.

Comparisons between the VFR groups show different rates for persons seeking pretravel health advice and different like-

lihoods of receiving diagnoses of specific travel-related illnesses. For most conditions and destinations, the proportional morbidity for the traveler VFR group lay somewhere between that of immigrant VFRs and tourist travelers.

Some specific diagnoses of systemic febrile illnesses that were more commonly received by immigrant VFRs, including malaria and typhoid fever, are partially preventable with appropriate pretravel advice and vaccination. Irrespective of destination, ill immigrant VFRs were significantly less likely to report having sought pretravel health advice than other ill travelers. The low proportion of immigrant VFRs who sought pretravel health care (284 [16%] of 1813 persons) may have contributed to the higher rate of certain illnesses among this group. Similar to our findings, a European airport study found that only 31.4% of VFRs sought health advice before travel, compared with 60.9% of tourists [5]. Previous reports suggest that immigrants from developing countries are often unaware of the potential risks of returning to their country of origin. Other barriers to pretravel advice include financial considerations, language barriers, and cultural beliefs. Even when pretravel advice is sought, adherence to recommendations is low [9, 25, 26].

We found that immigrant VFRs were more likely to receive a diagnosis of malaria than were tourist travelers and traveler VFRs. Regional differences were observed, with immigrant VFRs traveling to sub-Saharan Africa having >8 times the odds of contracting malaria, compared with tourist travelers. Of note,

**Table 4. Comparison of demographic characteristics of and diagnoses received by travelers to Latin America.**

Value	Immigrant VFRs (n = 336)	Traveler VFRs (n = 166)	Tourist travelers (n = 2581)	P	OR (95% CI)	
					Immigrant VFRs vs. traveler VFRs	Immigrant VFRs vs. tourist travelers
<b>Demographic characteristic</b>						
Male sex	149 (44)	77 (46)	1212 (47)	≥.4 <sup>a,b,c</sup>	0.9 (0.6–1.4)	0.9 (0.7–1.1)
Age, mean years (range)	43.1 (2–84)	33.4 (1–80)	35.0 (1–83)	≤.001 <sup>a,b</sup> ; .2 <sup>c</sup>		
Sought pretravel medical advice	29 (9)	68 (41)	1325 (51)	≤.001 <sup>a,b</sup> ; .12 <sup>c</sup>	0.1 (0.08–0.2)	0.08 (0.06–0.1)
Required inpatient treatment	43 (13)	4 (2)	92 (4)	≤.001 <sup>a,b</sup> ; >.6 <sup>c</sup>	6.1 (2.1–17.3)	4.1 (2.8–6.1)
Travel duration >30 days	99 (29)	56 (34)	752 (29)	>.2 <sup>a,b,c</sup>	0.8 (0.6–1.3)	1.0 (0.8–1.3)
<b>Diagnosis</b>						
Systemic febrile illness	53 (16)	23 (14)	255 (10)	≤.03 <sup>b,c</sup> ; >.5 <sup>a</sup>	1.2 (0.7–2.0)	2.0 (1.4–2.7)
Malaria	14 (4)	2 (1)	32 (1)	<.001 <sup>b</sup> ; >.07 <sup>a,c</sup>	1.0 (0.2–4.1)	3.4 (1.8–6.6)
Acute diarrhea	33 (10)	30 (18)	393 (15)	≤.009 <sup>a,b</sup> ; >.37 <sup>c</sup>	0.5 (0.3–0.8)	0.6 (0.4–0.9)
Chronic diarrhea	13 (4)	7 (4)	218 (8)	.003 <sup>b</sup> ; >.05 <sup>a,c</sup>	0.9 (0.4–2.3)	0.4 (0.2–0.8)
Nondiarrheal intestinal parasitic infection	28 (8)	3 (2)	36 (1)	≤.004 <sup>a,b</sup> ; .7 <sup>c</sup>	5.0 (1.5–16.4)	6.4 (3.9–10.6)
Respiratory syndrome	12 (4)	6 (4)	61 (2)	>.1 <sup>a,b,c</sup>	1.0 (0.4–2.7)	1.5 (0.8–2.9)
Dermatological condition	29 (9)	25 (15)	601 (23)	<.03 <sup>a,b,c</sup>	0.5 (0.3–0.9)	0.3 (0.2–0.5)

**NOTE.** Data are no. (%) of patients, unless otherwise indicated. Only diagnoses that were received by >1 person in each group are shown. Regarding those who traveled to North Africa, Eastern Europe, or Oceania who received specific diagnoses, the numbers of people were too small to reach statistical significance (data not shown). VFR, traveler who visits friends and relatives.

<sup>a</sup> Immigrant VFRs versus traveler VFRs.

<sup>b</sup> Immigrant VFRs versus tourist travelers.

<sup>c</sup> Traveler VFRs versus tourist travelers.

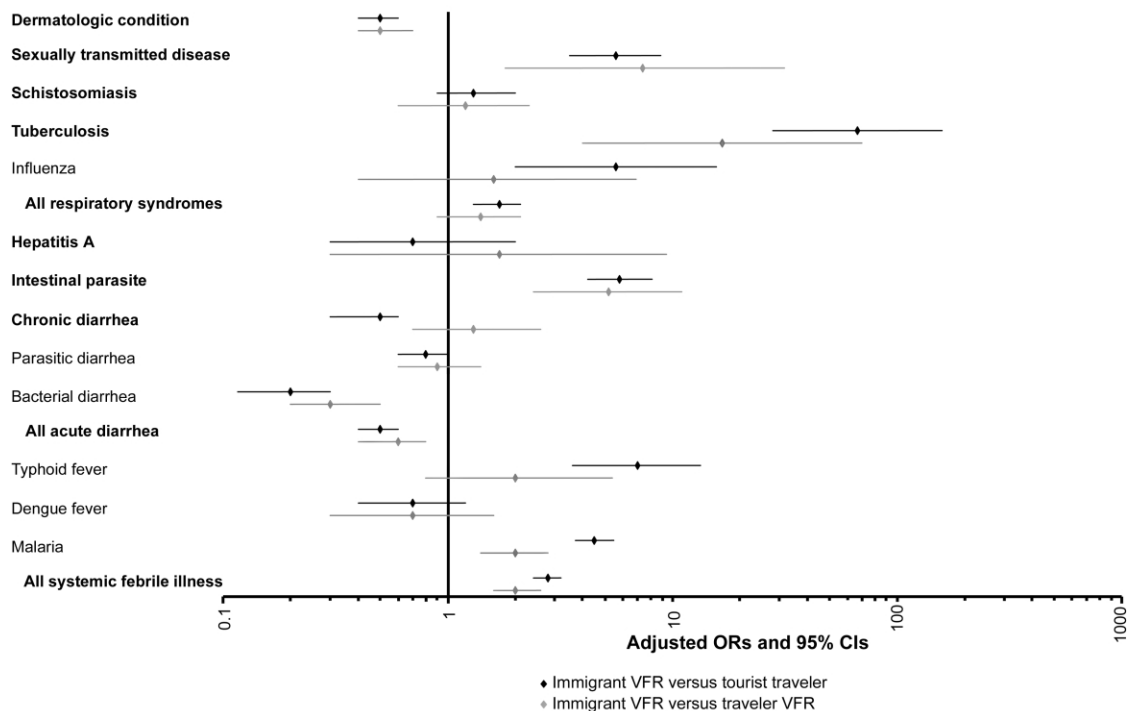
travel durations among immigrant VFRs were also longer for those who traveled to Africa, which may partly explain the differential result for people traveling to this destination. However, although trip durations to Asia and Latin America were similar among all groups, morbidity from malaria among immigrant VFRs was still statistically significantly greater, compared with morbidity among tourist travelers. Additionally, after aggregating data on travelers to all regions and adjusting for sex, age, duration of travel, and whether pretravel medical advice was sought, the odds of contracting malaria were 4.5 times greater among immigrant VFRs than they were among tourist travelers. We previously reported that the proportion of individuals with malaria presenting to a GeoSentinel site was 8 times greater among VFRs than among tourists (16.9% vs. 2.1%) [13]. Other studies have also reported higher rates of malaria among VFRs than among other travelers [1, 15, 26–32]. The results presented here, although consistent with previous findings, are based on more-specific VFR definitions and examination of malaria outcomes according to demographic characteristics and destination, and thereby support and extend the findings of previous studies.

It is notable that immigrant VFRs were significantly more likely to be admitted to the hospital than traveler VFRs or tourist travelers. This may be partly explained by the fact that systemic febrile illnesses were proportionately more common among this group, but it may also reflect differing criteria for

hospital admission, according to traveler group and the region visited.

Typhoid fever, respiratory syndromes (including influenza), and STDs stand out as other potentially preventable diseases that are proportionately more prevalent among immigrant VFRs. Our results confirm and extend the findings of previous studies regarding these illnesses. For example, 72% of typhoid infections reported to the Centers for Disease Control and Prevention during 1985–1994 were acquired abroad, and 77% of these cases were people who reported that the reason for their trip was to visit family [33]. In a previous review of GeoSentinel data, VFRs were 6 times more likely to receive a diagnosis of influenza than persons in other groups [16]. Immigrant VFRs tend to travel for longer periods and have closer contact with local residents, and it is of great concern that many VFRs are returning to areas of the world with high rates of HIV infection [34]. One study found that 44.5% of black Africans from central Africa now living in London had returned to their country of origin during the previous 5 years and that 40% of men and 21% of women had a new sexual partner while abroad. Of these persons, a total of 42% had not used a condom during their last intercourse [35]. Counseling for STD prevention has been shown to be effective in reducing STD rates among Peace Corps volunteers in Africa [36] and should be a high priority when immigrant VFRs present to travel clinics [37].

Some diseases that can be chronic in nature, including tu-



**Figure 1.** ORs (filled diamonds) and 95% CIs (horizontal lines) for disease diagnosis profiles among travelers who are immigrants visiting friends and/or relatives (immigrant VFRs), nonimmigrant traveler VFRs, and tourist travelers, adjusted for travel destination, duration, whether pretravel medical advice was sought, sex, and age.

berculosis and nondiarrheal intestinal parasitic infections, were diagnosed significantly more commonly in immigrant VFRs than in tourist travelers. This may be partly because of an increased likelihood of screening for these conditions, particularly for asymptomatic conditions, among immigrant VFRs. Additionally, it is impossible to know how many of these infections were related to recent travel and how many were acquired during periods of residence in areas of endemicity before immigration. Notably, adjusted analyses revealed no significant differences in the proportions of traveler VFRs and tourist travelers with these illnesses, nor in the proportional morbidity for schistosomiasis among the 3 groups.

In contrast to diagnoses more commonly received by immigrant VFRs, acute diarrheal illnesses and dermatological conditions were diagnosed in a significantly greater proportion of tourist travelers. Immigrant VFRs tend to observe significantly fewer food restrictions than tourists [5], supposedly leading to higher rates of food- and water-related infections [38]; however, it is possible that they may have some immunity. Additionally, immigrant VFRs may be more likely to seek care only for more life-threatening illnesses requiring hospitalization and may be less likely to present to a travel clinic or hospital with gastrointestinal or dermatological complaints.

The major limitation of this study is that individuals included in the GeoSentinel database are not representative of all trav-

elers. GeoSentinel sites are located primarily within academic centers, and patients presenting to other clinics with imported illnesses that are severe or persistent are more likely to be referred to GeoSentinel clinics [24]. Thus, our results may not be generalizable to other populations, such as persons presenting to primary care facilities. Additionally, the GeoSentinel database includes only data on returned travelers who became ill; travelers not requiring medical attention are not represented. Consequently, GeoSentinel data can be used to calculate relative morbidities among ill travelers but, because the denominator is unknown, they do not enable determination of the incidence of illness in VFRs. Finally, it is possible that the specific country of destination visited may have been a statistically significant factor in differing risks between groups, but this was not explored.

We have attempted to standardize the definition of VFR, and we propose that these more-precise definitions be used for future studies to allow meaningful comparisons across studies. We have also shown that immigrant VFRs and traveler VFRs have different demographic characteristics and patterns of travel-related illnesses and that there are regional differences for specific morbidities. We found ill VFRs to be significantly less likely to have sought pretravel medical advice than ill tourist travelers, and immigrant VFRs are especially prone to serious, potentially preventable, travel-related illness, such as malaria, typhoid fever, and STDs. More studies comparing patterns of

illnesses in these patient groups are required. We join the call to address barriers to the provision of travel-related medical services to this group of patients [38].

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