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Dermatologic conditions of the ill returned traveler: an analysis from the GeoSentinel Surveillance Network☆

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Summary
Background: Skin disorders are common in travelers. Knowledge of the relative frequency of post-travel-related skin disorders, including their geographic and demographic risk factors, will allow for effective pre-travel counseling, as well as improved post-travel diagnosis and therapeutic intervention.
Methods: We performed a retrospective study using anonymous patient demographic, clinical, and travel-related data from the GeoSentinel Surveillance Network clinics from January 1997 through February 2006. The characteristics of these travelers and their itineraries were analyzed using SAS 9.0 statistical software.
Results: A skin-related diagnosis was reported for 4594 patients (18% of all patients seen in a GeoSentinel clinic after travel). The most common skin-related diagnoses were cutaneous larva migrans (CLM), insect bites including superinfected bites, skin abscess, and allergic reaction (38% of all diagnoses). Arthropod-related skin diseases accounted for 31% of all skin diagnoses. Ill

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travelers who visited countries in the Caribbean experienced the highest proportionate morbidity due to dermatologic conditions. Pediatric travelers had significantly more dog bites and CLM and fewer insect bites compared with their adult counterparts; geriatric travelers had proportionately more spotted fever and cellulitis.
Conclusions: Clinicians seeing patients post-travel should be alert to classic travel-related skin diseases such as CLM as well as more mundane entities such as pyodermas and allergic reactions. To prevent and manage skin-related morbidity during travel, international travelers should avoid direct contact with sand, soil, and animals and carry a travel kit including insect repellent, topical antifungals, and corticosteroids and, in the case of extended and/or remote travel, an oral antibiotic with ample coverage for pyogenic organisms.
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Introduction

Skin disorders are among the six most common reasons returned travelers seek medical care;[1–3] potentially, 10% of travel-related skin conditions may be serious enough to lead to hospitalization.[4] Skin conditions develop as a result of a variety of factors: stressors of travel (including exposure to new medications), extremes of temperature and humidity, exposure to plant or animal toxins, infection with a local organism, or medical problems unrelated to travel, such as malignancy. Skin conditions may be associated with the length of stay and environmental risk factors. Travelers who choose to stay only in urban centers in first-class accommodation for brief periods are much less likely to acquire an 'exotic' skin disorder, whereas those living with locals in rural areas for prolonged stays are potentially at greater risk. Certain conditions, such as Buruli ulcers, are frequent in indigenous populations in Sub-Saharan Africa, but are exceedingly rare in the returned traveler;[5] at the other extreme, in some areas, cutaneous larva migrans (CLM) may represent up to 25% of the skin lesions seen in travelers.[4]

Prospective cohort studies,[4] chart reviews,[6] and case series[7] have been published in an effort to analyze skin conditions in travelers but have shown inconsistent findings or have been relatively small in scale.[7] Large-scale incidence data have not been previously published. One of the larger reviews evaluated fewer than 3000 travelers; 772 complained of medical problems, 3% of whom had a dermatologic complaint.[8]

As of March 1, 2006, the GeoSentinel Surveillance Network provided a denominator of over 50 000 patient encounters from 31 travel and/or tropical disease clinics around the world. The multicenter composition of the database ensures a heterogeneous representation of travel destinations, origins, and categories of ill returned travelers. These data provide an excellent reference point from which to approach pre-travel risk assessment and preparation concerning the prevention of skin disorders in the traveler. In addition, they will enable the clinician, whether an emergency room physician or a travel medicine specialist, to better formulate a post-travel differential diagnosis, direct appropriate diagnostic resources, and institute efficacious, timely therapy.

Methods

Data source

GeoSentinel is a global sentinel surveillance network established in 1995 through a cooperative agreement between the International Society for Travel Medicine (ISTM) and the Centers for Disease Control and Prevention (CDC) in Atlanta, USA.[9] It is composed of 31 globally dispersed physician-based travel/tropical medicine clinics chosen for their experience and training in travel and tropical medicine.[10] To be eligible for entry into the GeoSentinel database, patients must have crossed an international border within 10 years before seeking medical advice for a presumed travel-related illness or have been referred for a post-travel screening examination. The sites accounting for the majority of patient intake are within academic centers; several smaller-volume sites (almost all with current academic affiliation) are in free-standing locations. The intake at sites reflects a mixed population of tertiary care and self-referred patients. Some sites are restricted to outpatients, and no site has its entire practice limited to ill returned travelers.

Data collected include demographic data (age, sex, birth country, country of residence, and country of current citizenship) and travel history. Travel history includes more detailed itineraries for travel within 6 months of a GeoSentinel clinic visit, a record of all countries visited in the 5 years before the visit, and any relevant countries visited if the likely exposure was more than 5 years ago. All countries are categorized into one of 15 regions of the world. Depending upon the itinerary, multiple countries may have been recorded for a single trip. Other data recorded include the reason for most recent travel, major reasons for patient encounter (including skin problem), whether the patient reported receiving pre-travel health advice, most likely place of exposure, and setting of patient interaction (e.g., inpatient). The healthcare provider selects a final diagnosis(es) from a list of over 500 diagnoses and assesses the certainty of each diagnosis selected. All sites use the best available reference diagnostics in their own country. All information is entered anonymously into a central web-based SQL database.

Inclusion criteria

Data entered into the GeoSentinel database from January 1997 through February 2006 were reviewed. Only patients seen after travel, with a confirmed or probable final diagnosis were included; only returned travelers were included (i.e., immigrants, current expatriates, and travelers-in-transit were excluded). Patients were considered to have a dermatologic diagnosis if they had one of 63 possible diagnostic codes or if they had one of 36 diagnoses for which a skin manifestation is not an essential component, but had skin symptoms as a primary reason for seeking care (e.g., uncom-

plicated dengue fever, delusional parasitosis, all rickettsial diagnoses, onchocerciasis, loiasis, allergic reaction). Dermatologic diagnoses were divided into diagnostic categories that pertained to a possible source of exposure or etiology. These categories included trauma-induced, arthropod-borne, fungal, allergic, animal-related, soil-related, water-borne, food-borne, pyodermas, human exposure, pre-existing illness that may be exacerbated by travel, temperature exposure, and unknown.

Statistical analysis

The relative frequency of dermatologic diagnoses and their association with patient demographic and travel characteristics were analyzed using SAS version 9.0 (SAS Institute). Country-specific proportionate dermatology morbidity is defined as the number of patients with a subset of dermatologic diagnoses after travel to the country as a proportion of all ill returned travelers to the country with skin disease. Statistical significance for crude analysis of dichotomous variables was determined by the use of Chi-square test or Fisher's exact test with calculation of odds ratios (OR). Regional multivariate logistic regressions were employed to evaluate factors potentially associated with being diagnosed with a dermatologic condition relative to being diagnosed with another condition.

Results

A skin-related diagnosis was reported for 4594 patients (18% of all visits recorded at a GeoSentinel clinic after travel); since some individuals were diagnosed with more than one dermatologic condition, a total of 4742 diagnoses were recorded. A comparison of demographics, itinerary characteristics, clinical queries, and region of travel between travelers presenting with a dermatologic condition versus all other reasons to seek post-travel medical care is presented in Table 1. Patients with dermatologic diagnoses were more likely to have traveled in Southeast Asia and the Americas and less likely to have traveled in Africa and South Central Asia than were patients with other types of diagnoses. The results of multivariate logistic regression by region for these same variables are presented in Table 2. Based on the multivariate models, results that were both statistically significant and clinically significant showed that, although there were regional differences, travelers given a dermatologic diagnosis had greater odds of being younger (<18 years of age), traveling for tourism purposes, and presenting to a healthcare provider within a week of return, and lower odds of having fever, having a pre-travel health encounter, and traveling on a long itinerary (>8 weeks) relative to travelers with other diagnoses.

Characteristics of travelers with the ten most frequent dermatologic diagnoses and several other diagnoses of special interest are presented in Table 3. CLM, insect bites, and skin abscess were the three most frequent diagnoses; rash of unknown etiology comprised only 5.5% of all skin diagnoses. Travelers less than 18 years of age were more likely to be diagnosed with CLM and dog bites and less likely to be diagnosed with insect bites, dengue, or spotted fever group rickettsiae. In contrast, travelers over 65 years of age were more likely to have spotted fever group rickettsiae or cellulitis and less likely to have CLM or dengue. In comparison with their male counterparts, a greater proportion of female travelers were diagnosed with insect bites or an allergic rash whereas a smaller proportion of females were diagnosed with skin abscess or leishmaniasis. In the following countries, one disease entity accounted for greater than one third of all dermatologic diagnoses: CLM (Barbados, Jamaica), leishmaniasis (Bolivia), spotted fever group rickettsiae (Zimbabwe, South Africa), and myiasis (Belize). Countries of exposure with the highest overall proportion of morbidity attributable to dermatologic diagnoses were Barbados, Belize, Jamaica, and Bolivia. The diagnoses with the greatest percentage of individuals traveling on long itineraries (>8 weeks) were leishmaniasis (61%), scabies (42%), and rash of unknown etiology (40%); 32% of travelers presenting with a dog bite were traveling on brief itineraries (<8 days).

In an attempt to quantify the exposures/etiologies responsible for travel-related dermatologic diagnoses, Table 4 outlines the dermatologic diagnoses by category. Arthropod-related diagnoses are by far the most common (30.9%); diagnoses of unknown etiology and pyodermas comprise 14.6% and 12.8%, respectively.

Discussion

Dermatologic conditions are common in the returned traveler and were recognized during 18% of visits in ill returning travelers at GeoSentinel Network clinics. This is consistent with previous reports from the GeoSentinel Network[10] but higher than the 8–9% reported in other prospective studies of returned travelers[2] and travelers in transit.[11] The current study represents the largest retrospective series of travelers presenting with dermatologic conditions reported in the literature. Compared with the largest prospective series from a French clinic (N = 269) by Caumes et al.,[4] demographic characteristics are very similar. Consistent with our findings, Caumes et al. reported that over 75% of their patients were returning from tourism-related travel.[4] Both series report a good deal of overlap in the most frequent diagnoses, including insect bites, pyodermas, and CLM. Several differences are worth noting, however. GeoSentinel patients traveled proportionately more in Asia, whereas the Caumes series had a greater percentage returning from Africa and the Caribbean. Furthermore, tungiasis was much less frequent in our series (only 31 diagnoses of 4742). In addition, Caumes et al. concluded that 53% of their patients had a classical tropical disease (e.g., CLM, myiasis, leishmaniasis, dengue), whereas only 24% of our patients did. The higher frequency in Caumes' study is likely due to their inclusion of travelers only returning from 'tropical countries', whereas the GeoSentinel Network includes travelers returning from temperate regions (Table 1); furthermore, since the patients in Caumes' series were referred from healthcare providers, those with more mundane conditions may not have been referred.

There were significant relationships between dermatological diagnoses and demographic and clinical characteristics of the ill returned travelers; due to the large sample size of this dataset, most variables in the univariate analysis (Table 1) were statistically significant. Therefore, we focus our discussion on the findings of the multivariate analysis

Table 1 Basic characteristics: ill returned travelers with a dermatologic diagnosis vs. all other patients in the GeoSentinel Surveillance Network database[a]

	Ill returned travelers with skin disease (N = 4594)	All other ill returned travelers (N = 20 326)
Demographics[b]		
Age <18 years	6.0% (277)	4.3% (868)
Age 18–65 years	88.9% (4085)	91.2% (18 543)
Age >65 years	4.7% (214)	3.9% (791)
Female	49.6% (2280)	47.1% (9578)
Region of travel		
Southeast Asia	18.7% (857)	14.0% (2837)
Sub-Saharan Africa	18.0% (825)	26.4% (5376)
South America	13.3% (612)	8.9% (1815)
South central Asia	11.3% (517)	13.7% (2786)
Central America	9.4% (434)	7.1% (1433)
Caribbean	8.7% (401)	5.3 % (1069)
Western Europe	4.1% (187)	3.1% (630)
North Africa	2.9% (132)	4.4% (898)
Other regions, including multiple[c]	13.7% (629)	17.1% (3482)
Clinical characteristics		
Fever	12.1% (556)	31.5% (6401)
Inpatient	5.7% (260)	10.3% (2094)
Pre-travel encounter	49.0% (2249)	53.2% (10 816)
Purpose of travel		
Tourism	69.1% (3175)	56.1% (11 409)
Business	10.4% (477)	14.9% (3036)
Research/education	3.9% (178)	4.4% (890)
Missionary/volunteer	5.5% (253)	9.2% (1865)
Visiting friends/relatives	10.9% (500)	15.0% (3040)
Travel duration		
<2 weeks	23.2% (1064)	21.2% (4303)
2–8 weeks	35.3% (1620)	32.9% (6679)
>8 weeks	27.6% (1267)	33.9% (6883)
Time to HCP visit		
<8 days	33.8% (1554)	29.4% (5985)
8–35 days	31.0% (1424)	29.5% (6006)
>35 days	32.6% (1496)	38.4% (7796)

HCP = healthcare provider.

[a] Missing data: age (142), sex (385), fever (0), inpatient (900), pre-travel encounter (314), purpose of travel (97), travel duration (3104), time to HCP visit (659).

[b] p-Value calculated by Chi-square test was statistically significant (i.e., $p < 0.05$) for all variables except time to HCP visit (8–35 days) and purpose of travel (research/education).

[c] Other regions include East Asia, Australia/New Zealand, Eastern Europe, Oceania, Antarctica, multiple regions, and cruise ship/airport/airplane.

(Table 3). There was a significantly higher number of children in our series when compared with all GeoSentinel travelers. This might in part be explained because CLM was the most frequent dermatologic diagnosis and the risk of CLM is associated with skin exposure to sand, whether on a beach or in a sandbox.[12] Travelers less than 18 years of age, who may be more likely to have barefoot exposure to sand, were indeed more likely to be diagnosed with CLM. The greater proportion of ill travelers presenting to a healthcare provider within one week of their return may have resulted from a combination of the short CLM incubation period (median of 8 days in the Caumes study) and a variety of other relatively acute conditions (pyodermas, arthropod and animal bites) for which travelers might be expected to have sought healthcare urgently. Febrile returned travelers in this study were rare, since the majority of dermatologic conditions are not classically associated with fever (e.g., CLM, arthropod bite, allergic rash, superficial fungal infection).

The Caribbean region, including countries that border the Caribbean (i.e., Belize), has a strikingly high proportionate morbidity due to dermatologic diagnoses, yet is associated with the least amount of pre-travel counseling (Table 2) as well as a shorter length of travel, suggesting missed opportunities for the dissemination of prevention messages. As exposed skin is at greater risk for arthropod bites, solar damage, parasite infiltration, and contact with irritants

Table 2 Basic characteristics of ill returned travelers with a dermatologic diagnosis vs. all other patients in the GeoSentinel Surveillance Network database: odds ratio point estimates (95% confidence intervals) for variables used in the multivariate regression models for selected regions of travel

	Southeast Asia (n = 857)	Sub-Saharan Africa (n = 825)	South America (n = 612)	South Central Asia (n = 517)	Central America (n = 434)	Caribbean (n = 401)	Western Europe (n = 187)	North Africa (n = 132)
Demographics								
Age <18 years	NS	1.54 (1.12–2.12)	NS	1.90 (1.24–2.91)	NS	2.30 (1.43–3.69)	2.29 (1.18–4.45)	2.96 (1.72–5.09)
Age 18–65 years[a]								
Age >65 years	NS	1.93 (1.36–2.73)	NS	NS	NS	NS	NS	NS
Female	NS	NS	0.69 (0.57–0.84)	NS	NS	NS	NS	NS
Clinical characteristics								
Fever (yes)	0.25 (0.21–0.31)	0.26 (0.22–0.32)	0.17 (0.12–0.25)	0.42 (0.33–0.54)	0.29 (0.20–0.42)	0.22 (0.15–0.33)	0.28 (0.15–0.52)	0.40 (0.23–0.68)
Inpatient (yes)	NS	NS	1.79 (1.16–2.74)	NS	NS	NS	NS	NS
Pre-travel encounter (no)	1.31 (1.10–1.56)	NS	NS	NS	NS	1.84 (1.43–2.38)	NS	1.61 (1.10–2.34)
Reason for travel								
Tourism[a]								
Business	0.60 (0.45–0.80)	0.65 (0.52–0.81)	0.56 (0.41–0.78)	NS	0.36 (0.22–0.59)	NS	NS	NS
Research/education	NS	NS	NS	NS	0.44 (0.26–0.75)	NS	NS	NS
Missionary/volunteer	0.44 (0.27–0.70)	0.70 (0.55–0.90)	0.25 (0.18–0.35)	NS	0.26 (0.17–0.41)	NS	NS	NS
Visiting friends/ relatives (VFR)	NS	0.70 (0.56–0.86)	0.64 (0.47–0.86)	NS	0.45 (0.27–0.74)	0.28 (0.17–0.47)	NS	NS
Travel duration								
<2 weeks	NS	NS	NS	NS	NS	NS	NS	NS
2–8 weeks[a]								
>8 weeks	0.77 (0.63–0.94)	0.61 (0.51–0.72)	NS	0.81 (0.66-0.99)	NS	0.66 (0.48–0.92)	NS	NS
Time to HCP visit								
<8 days	1.22 (1.01–1.47)	NS	NS	1.37 (1.13–1.67)	NS	1.61 (1.22–2.11)	NS	NS
8–35 days[a]								
>35 days	0.63 (0.51–0.77)	NS	0.79 (0.65–0.97)	NS	0.61 (0.48–0.77)	NS	0.40 (0.28–0.57)	0.56 (0.37–0.84)

NS = not statistically significant.
Multiple logistic regressions performed for each region with $n > 100$.
Explanatory variables in regression analysis included inpatient status, fever, age, sex, reason for travel, duration, time to presentation, pre-travel consultation.
[a] Reference group for non-dichotomous variables.

Table 3 Ten most frequent diagnoses and additional diagnoses of interest — comparison with all ill returned travelers with dermatologic diagnoses

Diagnosis (*n*)	% of all dermatologic diagnoses	% Female	% Pediatric (age 0—17)	% Geriatric (age > 65)	Country-specific proportionate morbidity (fraction)[b]	% with pre-travel encounter	Primary reasons for travel (%)[c]	Travel duration % <2 weeks % >8 weeks
All (4742)	100	50	6.0	4.7	Barbados (39/65) Belize (49/85) Jamaica (81/146) Bolivia (105/227)	49	Tourism (69) VFR (11)	23 28
CLM (465)	9.8	48	9.9[a]	2.0[a]	Barbados (29/39) Jamaica (44/81) Malaysia (13/42)	44[a]	Tourism (87) Business (4)	25 19[a]
Insect bite (388)	8.2	62[a]	3.1[a]	6.5	USA (12/54) Peru (13/68) Costa Rica (17/105)	50	Tourism (77) Business (9)	28[a] 15[a]
Skin abscess (366)	7.7	43[a]	3.9	3.3	Madagascar (9/35) Kenya (14/85) Philippines (13/84)	58[a]	Tourism (69) VFR (11)	14[a] 32[a]
Superinfected insect bite (324)	6.8	54	6.2	3.1	Sri Lanka (24/121) South Africa (16/115) Thailand (43/468)	63[a]	Tourism (79) VFR (10)	13[a] 15[a]
Allergic rash (263)	5.5	62[a]	6.1	2.3	Dominican Republic (12/98) India (25/268) Brazil (16/222)	58[a]	Tourism (67) Business (15)	18 23
Rash, unknown etiology (262)	5.5	52	4.2	6.9	Mexico (11/150) Brazil (15/222) India (11/268)	52	Tourism (69) Business (10)	24 40[a]
Dog bite (203)	4.3	47	12.0[a]	3.0	China (15/44) Vietnam (10/49) Thailand (46/468)	38[a]	Tourism (69) VFR (15)	32[a] 16[a]
Superficial fungal infection (190)	4.0	45	5.8	2.1	Sri Lanka (7/121) Thailand (18/468) Brazil (9/222)	59[a]	Tourism (56) MV (16)	14[a] 37[a]
Dengue (159)	3.4	48	1.3[a]	0.6[a]	Indonesia (13/120) Thailand (33/468) India (18/268)	57	Tourism (64) Business (13)	29 23
Leishmaniasis (158)	3.3	34[a]	8.3	7.0	Bolivia (52/105) Costa Rica (13/105) Peru (7/68)	61[a]	Tourism (63) RE (11)	15[a] 61[a]

Myiasis (126)	2.7	49	3.2	5.6	Belize (21/49) Bolivia (21/105) Costa Rica (11/105)	62[a]	Tourism (83) Business (8)	23 29
Spotted fever group rickettsiae (72)	1.5	42	0.0[a]	11.4[a]	Zimbabwe (5/7) South Africa (48/115)	60	Tourism (75) Business (21)	23 10[a]
Scabies (71)	1.5	47	4.2	7.0	Guyana (5/38) Costa Rica (5/105) Brazil (4/222)	55	Tourism (58) MV (15)	11[a] 42[a]
Cellulitis (70)	1.5	39	2.9	14.3[a]	Indonesia (4/120) India (5/268) Brazil (3/222)	36[a]	Tourism (59) VFR (17)	27 26

VFR = visiting friends/relatives; MV = missionary/volunteer; RE = research/education; CLM = cutaneous larva migrans.

[a] Value was significantly different from reference group (All, row 1) by Chi-square test or Fisher's exact test, where appropriate (pediatric reference = age > 17 years; geriatric reference = age < 66 years; gender reference = male; pre-travel encounter reference = no encounter).

[b] Countries are the top two to four countries with ill returned travelers reporting that diagnosis.

[c] Reasons for recent travel reported are the top two with ill returned travelers reporting that diagnosis. Denominators are the total N for the row, except for country-specific morbidity where the denominator is the number of ill returned travelers with any dermatological diagnosis after travel to that country.

and allergens, travel to regions where travelers are apt to be scantily clad naturally will pose a greater risk for dermatologic conditions. For some distinct clinical entities such as CLM and leishmaniasis, a high proportion of the reported morbidity was associated with travel to a small number of countries. This finding is in stark contrast to diagnoses such as rash of unknown etiology, superficial fungal infection, and cellulitis, which are unlikely to be associated with a particular country/region or a memorable exposure. While these data do not imply that travelers to other countries are not at risk for these diagnoses, knowledge of disease entity/country pairs with high proportionate morbidity provides a unique opportunity for healthcare providers to offer special pre-travel counseling regarding appropriate preventive measures.

The large base of travelers in the GeoSentinel Network allows for a more detailed analysis of dermatologic diagnoses too rare for most single clinics to perform. For example, we compared 158 cases of cutaneous leishmaniasis with those in three other series.[13–15] In all series, including our own, leishmaniasis was associated with a male predominance and a long duration of travel. Central and South American countries (particularly Bolivia) were frequently reported as the place of exposure in all series, including our own. Madidi National Park, a popular tourist destination in Bolivia, emerged as a leading site of exposure in the Scope series[14] as well as our own. For myiasis, the mean age and median length of stay in the one heterogeneous series[16] were quite similar for our dataset (data not shown). The series by Tamir et al. consisted of young Israeli tourists, most of whom had returned from Madidi National Park in Bolivia.[17] In our study, although fewer ill travelers had been to Belize than Bolivia, myiasis morbidity as a proportion of all dermatologic morbidity for Belize was twice that of Bolivia. Unlike the results of our study, in which the sex ratio was almost equal for both New World and Old World cutaneous myiasis (data not shown), other case series have reported a predominance of females[16,18,19] contracting *Dermatobia hominis* in the New World, but male predominance for patients infected with *Cordylobia anthropophaga*[16] in the Old World. This difference could be due to the small sample size in other case series or a change in demographics of travelers at risk. Over 200 dog bites are reported in our series, the greatest proportionate morbidity of which can be attributed to China, Vietnam, and Thailand. Children had a greater likelihood of presenting with a dog bite. In numerous non-travel related scenarios, children have been noted to be at higher risk for dog bites,[20,21] especially in the head and neck area,[22] locations that are known risk factors for rapid progression of rabies infection.[23] The GeoSentinel Network has thoroughly reviewed this topic elsewhere.[24] Since spotted fever rickettsial diagnoses include many separate entities with a wide geographic distribution it would be difficult to compare these cases with other reports in the literature. However, these data may indicate that older individuals are at greater risk for presenting with spotted fever; this may be related to the greater disposable income and leisure time required for many African safari itineraries.

Knowledge about risks due to particular exposures/etiologies can provide a basis for prevention strategies. Due to the preponderance of arthropod-related disease, the use of insect repellant cannot be stressed enough for the prevention

Table 4 Composition of disease categories

Disease category (most frequent diagnoses under that category in rank order)	All dermatologic diagnoses *N* = 4742 (100%)
Arthropod-related (insect bite, insect bite (superinfected), dengue, cutaneous leishmaniasis)	1466 (30.9%)
Unknown (rash, unknown etiology, urticaria, pruritus of unknown etiology)	694 (14.6%)
Pyodermas (skin abscess, cellulitis, erysipelas)	609 (12.8%)
Soil-related (CLM, tungiasis)	496 (10.5%)
Animal-related (dog bite, monkey bite, bite — other animal)	439 (9.3%)
Allergic in nature (allergic rash, allergic reaction)	263 (5.5%)
Human to human (scabies, leprosy, syphilis, varicella)	233 (4.9%)
Fungal origin (fungal rash, superficial fungal infection)	211 (4.4%)
Endogenous (HSV, herpes zoster, psoriasis)	129 (2.7%)
Trauma-related (laceration, contusion)	68 (1.4%)
Water-borne (marine bite/sting, sea-bathers eruption)	64 (1.3%)
Drug-related (drug-related rash, non-mefloquine adverse reaction)	42 (0.9%)
Temperature-related (frostbite, sunburn)	21 (0.4%)
Food-borne (cutaneous/subcutaneous cysticercosis)	7 (0.1%)

CLM = cutaneous larva migrans; HSV = herpes simplex virus.

of both dermatologic conditions as well as life threatening travel-related illness caused by malaria and arboviruses.[25] In our series, pyodermas comprised nearly 13% of dermatologic diagnoses, findings similar to a recent study by Ansart et al., which found that 21% of dermatoses in returned travelers were due to pyodermas.[26] For extended and/or remote itineraries, travel kits should include a topical antibiotic (e.g., mupirocin) for self-treatment of early lesions, as well as an oral antibiotic with staphylococcal/streptococcal coverage for self-treatment of a more extensive pyoderma. Given the rise in drug-resistant bacteria (e.g., methicillin-resistant *Staphylococcus aureus* — MRSA) in many parts of the world, travelers should be counseled to seek medical care urgently should self-treatment of a pyoderma fail. In addition, given the high frequency of this condition, practitioners should stress attention to personal hygiene, especially in the setting of arthropod bites and trauma. Soil and animal-related conditions each accounted for approximately 10% of diagnoses. A pre-travel focus on the use of proper footwear (especially for Caribbean vacations) and avoidance of animals, both wild and domestic (particularly in Asia), should be emphasized; interestingly, both travelers at risk for animal bites as well as CLM are among the least likely to have pre-travel consultation. Our study also suggests that animal bites are not limited to individuals traveling on a longer itinerary; likewise, Gautret et al. found no distinction in length of itinerary among travelers who sustain animal bites during travel.[24] Therefore, it may be worthwhile to consider pre-exposure rabies vaccination for travelers on shorter itineraries destined for remote areas of Asia with high proportionate morbidity for animal bites (e.g., China, Vietnam, Thailand).

Several limitations of this study are noteworthy. First, since the GeoSentinel Network represents a sample of ill travelers, the incidence and risk of returning with any given diagnosis cannot be calculated. However, proportionate morbidity, or the ratio of ill travelers with a subset of diagnoses to all ill returned travelers for a given country can be calculated to compare relative frequencies of illness in ill returned travelers.

Second, the authors acknowledge that most travel medicine physicians are not dermatologists and therefore the accuracy of some diagnoses may be in question. However, our results reflect the types of illnesses severe enough for returned travelers to seek care at a site known for expertise in travel/tropical medicine. Many of the most frequent diagnoses (e.g., CLM, skin abscess, dog bite, myiasis, leishmaniasis) have classical appearances and the accuracy of these diagnoses is likely to be quite high in light of the extensive experience of travel medicine specialists in our network. Many dermatological conditions are self-limited and so may have resolved before a clinic visit or confirmation of the etiology was possible. To reduce the uncertainty of diagnoses, we selected only patients with diagnoses that were confirmed or probable. In spite of this approach, 5.3% of cases were deemed 'rash, unknown etiology', a reasonable number under these circumstances. By comparison, in the Caumes study, 3.3% of patients were classified as 'undetermined' and 4.1% as 'rash and fever'.[4] It is interesting to note that travelers seen with rash of unknown etiology had a greater likelihood of being on an itinerary of greater than 8 weeks. This duration may be an indication of the complexity of the itinerary (i.e., multiple countries) or simply of the increased time interval between the exposure and the clinic visit; both may contribute to recall bias and a failure to recount important exposures responsible for the condition. There is also a limited ability to recall patients for additional history or diagnostics because of the limitations of insurance, manpower, and patient willingness.

Third, since our patients are reported through a sentinel travel/tropical medicine surveillance network, patients who sought care elsewhere (i.e., at a non-specialized or primary care practice or with a dermatologist) on return are not included. Data also would not be captured if the traveler were treated successfully abroad or if their lesions had resolved before medical care was sought. Hill reported that

7% of his travel cohort sought care for a dermatologic condition during travel.[2]

In summary, dermatologic conditions are common in travelers and were found in 18% of ill returned travelers seen at a GeoSentinel Network site; CLM, skin abscess, and arthropod bites were the three most common diagnoses. Ill travelers who visited countries in the Caribbean experienced the highest proportionate morbidity due to dermatologic conditions. Many dermatologic conditions related to travel could be prevented by consistently applying arthropod repellent, wearing closed shoes, maintaining good skin hygiene, and avoiding feral and domesticated animals. Pediatric travelers have increased odds of returning with a dermatologic condition. Children require parental supervision to ensure prevention measures are properly employed, especially with regards to contact with soil/sand and animals. Travel kits should include diethyltoluamide (DEET)-based arthropod repellent, low dose topical corticosteroid, and antifungal cream, as well as instructions for the proper indication and use of all contents. Oral as well as topical antibiotics against staphylococcal/streptococcal infections should be provided for remote and/or prolonged itineraries where self-treatment by travelers may be necessary.

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