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Pretravel Health Preparation of International Travelers: Results From the Boston Area Travel Medicine Network

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Abstract

Objective: To inform future interventions for advising travelers.

Patients and Methods: We prospectively collected data on travelers seen at the Boston Area Travel Medicine Network, a Boston area research collaboration of 5 travel medicine clinics. Data from 15,440 travelers were collected from March 1, 2008, through July 31, 2010. We compared traveler and trip characteristics and differences in demographic characteristics and travel plans across the 5 clinics, including an analysis of pretravel preparations for certain high-risk destinations.

Results: More than half of the 15,440 travelers were female (8730 [56.5]), and 72.4% (10,528 of 14,545) were white; the median age was 34 years, and 29.4% of travelers (3077 of 10,483) were seen less than 2 weeks before their departure date. Substantial variation in racial background, purpose of travel, and destination risk existed across the 5 clinics. For example, the proportion of travelers visiting friends and relatives ranged from 7.6% (184 of 2436) to 39.0% (1029 of 2639) (18.7% [2876 of 15,360] overall), and the percentage of travelers to areas with malaria risk ranged from 23.7% (333 of 1403) to 52.0% (1306 of 2512). Although most clinics were likely to have prescribed certain vaccines for high-risk destinations (eg, yellow fever for Ghana travel), there was wide variability in influenza vaccine use for China travel.

Conclusion: Substantial differences in clinic populations can occur within a single metropolitan area, highlighting why individual physicians and travel clinics need to understand the specific needs of the travelers they serve in addition to general travel medicine.

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International travel has increased steadily in recent decades. In 2015, nearly 1.2 billion people traveled internationally, a 40-fold increase since 1950.[1] Pretravel health consultations prepare travelers for safe and healthy travel by providing itinerary-specific education, immunizations, and medications for chemoprophylaxis or self-treatment. These consultations also provide excellent opportunities for updating routine vaccinations. Past studies have found that the depth and quality of pretravel information and interventions are highly variable despite guidelines from the Centers for Disease Control and Prevention (CDC), Infectious Diseases Society of America, and other national and international agencies.[2-5]

Travelers at increased risk of travel-related infectious diseases include those visiting friends and relatives (VFR travelers), pregnant women, older adults, and individuals with comorbidities including cardiovascular disease, immunocompromised states, and diabetes mellitus. Individuals who travel for longer than 6 months are at greater risk than short-term travelers for persistent and postinfectious diarrhea, malaria, and parasitic infections.[6] These groups warrant greater attention to identify barriers to care and develop targeted strategies for improving travelers' health.

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Although many studies have described the types and impact of travel-related illness on the health of returning travelers,[6-9] few have described the characteristics of outgoing travelers and their trips.[10,11] The Boston Area Travel Medicine Network (BATMN) is a research collaboration of 5 travel medicine clinics in the greater Boston area. To help inform future interventions for traveler preparation, we collected data on travelers seen at BATMN clinics including timing of consultations, traveler characteristics, common destinations, trip characteristics, and differences in traveler demographic characteristics across the 5 clinics.

PATIENTS AND METHODS

Data Collection

Data from 15,440 travelers were collected from March 1, 2008, to July 31, 2010, including traveler demographic characteristics, trip characteristics, medical history, and vaccinations, medications, and travel medicine advice given at the pretravel visit. Demographic information included age, sex, race/ethnicity, country of origin, year of arrival in the United States, parents' countries of origin, and primary language. Trip characteristics included destination countries, departure and return dates, purpose of travel, and type of accommodations. Travel medicine physicians documented advice, but templates used to collect these data differed by clinic. Detailed analyses of pediatric VFR travelers and those with medical comorbidities and immunocompromising conditions have been published previously.[12,13]

Study Sites

The BATMN clinics have different traveler populations. Clinics A and B are based at urban teaching hospitals, but Clinic B has a broad patient base that includes a substantial proportion of minorities, recent immigrants, and refugees. Clinic C, at a suburban university-affiliated hospital, serves many multinational corporations whose employees travel frequently. Clinic D, another teaching hospital, has a broad patient population. Clinic E is in Boston's Chinatown at an academic medical center. Clinics B, C, and E provide services for travelers of all ages; Clinic A sees only adults (≥18 years), and Clinic D sees adults and older children. Physicians direct each clinic. Staff providing pretravel consultation vary by clinic and include nurses, nurse practitioners, and physicians. The institutional review boards of all sites reviewed and approved the study procedures. The study was approved by the institutional review boards of all participating institutions and of the CDC. A waiver of informed consent was provided, given the minimal risk to participants of having their de-identified data extracted from the medical record.

Data Extraction and Statistical Analyses

Anonymized individual traveler data were extracted from paper medical records for 4 sites and downloaded from electronic medical records from Clinic B. Data from paper records were entered into an electronic database (CSPro, version 4.0; US Census Bureau) and merged with the downloaded electronic medical record data.

Data were analyzed using SAS software, version 9.4 (SAS Institute). We used the χ^2 test to compare frequencies and the Wilcoxon rank sum test to compare continuous variables. We report frequencies for categorical demographic variables and median and range or interquartile range (IQR) for continuous demographic variables. The United Nations Statistics Division list of countries and regions was used to categorize geographical regions and subregions.[14] Malaria (total/partial/none) risk destination and yellow fever (YF) risk (classified as holoendemic/partially endemic/none) countries were assigned according to CDC classifications, corresponding to our study period.[15] Countries with typhoid fever risk were categorized as high (>100 annual cases per 100,000 person-years), medium (10-100 annual cases per 100,000 person-years), and low (<10 annual cases per 100,000 person-years) incidence.[16] For purposes of analysis, only total malaria, holoendemic YF, and high typhoid risk countries were considered at-risk destinations. To assess vaccination practices, we selected specific countries at high risk for certain vaccine-preventable diseases (India, typhoid; Ghana, YF; Nigeria, polio; and China, influenza) and then quantified the proportion of travelers who were up-to-date with or received the relevant vaccinations. For the analysis of counseling, missing responses were recorded as not done.

TABLE 1. Demographic and Trip Characteristics of Travelers Seen at Boston Area Travel Medicine Clinics Before Trip Departure (March 2008-July 2010), Stratified by Clinic[a,b]

Variable	Clinic A (n=3269)	Clinic B (n=2512)	Clinic C (n=1403)	Clinic D (n=6668)	Clinic E (n=1588)	All travelers (N=15,440)
Traveler characteristics						
Female	1890 (57.8)	1451 (57.8)	698 (49.8)	3796/6667 (56.9)	895 (56.4)	8730/15,439 (56.5)
Age (y)						
Median (IQR)	36 (26-53)	29 (21-42)	48 (31-60)	34 (25-51)	30 (20-46)	34 (24-51)
<1	0 (0)	43 (1.7)	2 (0.1)	0 (0)	3 (0.2)	48 (0.3)
1 to <2	0 (0)	51 (2.0)	0 (0)	1 (0.02)	36 (2.3)	88 (0.6)
2-10	0 (0)	219 (8.7)	3 (0.2)	83 (1.2)	164 (10.3)	469 (0.6)
11-18	39 (1.2)	173 (6.9)	66 (4.7)	682 (10.2)	166 (10.5)	1126 (7.3)
19-64	2963 (90.6)	1921 (76.5)	1129 (80.5)	5453 (81.8)	1121 (70.6)	12,587 (81.5)
≥65	267 (8.2)	105 (4.2)	201 (14.3)	449 (6.7)	98 (6.2)	1120 (7.3)
Race/ethnicity						
Asian	246/3105 (7.9)	240/2439 (9.8)	143/1375 (10.4)	500/6115 (8.2)	270/1511 (17.9)	1399/14,545 (9.6)
Biracial/multiracial	28/3105 (0.9)	34/2439 (1.4)	8/1375 (0.6)	145/6115 (2.4)	10/1511 (0.7)	225/14,545 (1.5)
Black	218/3105 (7.0)	856/2439 (35.1)	34/1375 (2.5)	296/6115 (4.8)	219/1511 (14.5)	1623/14,545 (11.2)
Hispanic/Latino	92/3105 (3.0)	151/2439 (6.2)	21/1375 (1.5)	153/6115 (2.5)	60/1511 (4.0)	477/14,545 (3.3)
White	2441/3105 (78.6)	1106/2439 (45.3)	1160/1375 (84.4)	4912/6115 (80.3)	909/1511 (60.2)	10,528/14,545 (72.4)
Other	78/3105 (2.5)	51/2439 (2.1)	9/1375 (0.7)	109/6115 (1.8)	43/1511 (2.8)	290/14,545 (2.0)
Primary language English	3234 (98.9)	2022 (80.5)	628/687 (91.4)	5527 (82.9)	903/1044 (86.5)	12,314/14,180 (86.8)
Born in the US	2283/2864 (79.7)	1403/2296 (61.1)	1143/1402 (81.5)	5352/6619 (80.9)	565/815 (69.3)	10,746/13,996 (76.8)
At least one parent's country of origin not US	885/2775 (31.9)	709/1149 (61.7)	390/1359 (28.7)	1847/5471 (33.8)	390/743 (52.5)	4221/11,497 (36.7)
Reason for travel[c]						
Tourism	1506/2436 (61.8)	1055/2639 (40.0)	1158/1709 (67.8)	3743/6851 (54.6)	1059/1725 (61.4)	8521/15,360 (55.5)
Visiting friends/relatives	184/2436 (7.6)	1029/2639 (39.0)	243/1709 (14.2)	1005/6851 (14.7)	415/1725 (24.1)	2876/15,360 (18.7)
Business	399/2436 (16.3)	209/2639 (7.9)	298/1709 (17.4)	1135/6851 (16.6)	138/1725 (8.0)	2179/15,360 (14.2)
Research/education	151/2436 (6.2)	411/2639 (15.6)	145/1709 (8.5)	496/6851 (7.2)	144/1725 (8.3)	1347/15,360 (8.8)
Missionary/volunteer	345/2436 (14.2)	248/2639 (9.4)	155/1709 (9.1)	600/6851 (8.8)	172/1725 (10.0)	1520/15,360 (9.9)
Other	27/2436 (1.1)	37/2639 (1.4)	19/1709 (1.1)	115/6851 (1.7)	43/1725 (2.5)	241/15,360 (1.6)
Time to departure						
Median, d (IQR)	25 (13-39)	19 (10-33)	29 (13-48)	23 (11-41)	22 (12-38)	23.0 (12-40)
0-6 d	211/2210 (9.5)	327/2309 (14.2)	185/1368 (13.5)	457/3616 (12.6)	113/980 (11.5)	1293/10,483 (12.3)
7-13 d	363/2210 (16.4)	469/2309 (20.3)	164/1368 (12.0)	635/3616 (17.6)	153/980 (15.6)	1784/10,483 (17.0)
2-4 wk	626/2210 (28.3)	697/2309 (30.2)	311/1368 (22.7)	1013/3616 (28.0)	332/980 (33.9)	2979/10,483 (28.4)
<1-4 mo	972/2210 (44.0)	791/2309 (34.3)	681/1368 (49.8)	1447/3616 (40.0)	368/980 (37.6)	4259/10,483 (40.6)
>4 mo	36/2210 (1.6)	23/2309 (1.0)	25/1368 (1.8)	59/3616 (1.6)	13/980 (1.3)	156/10,483 (1.5)
Trip duration						
Median, d (IQR)	14 (10-23)	21 (13-38)	14 (10-21)	15 (10-26)	17 (10-30)	15 (10-29)
<2 wk	1719 (52.6)	755/2259 (33.4)	677/1353 (50.0)	3328 (49.9)	711 (44.8)	7190/15,137 (47.5)
2-4 wk	1016 (31.1)	686/2259 (30.4)	509/1353 (37.6)	2120 (31.8)	524 (33.0)	4855/15,137 (32.1)
1-4 mo	365 (11.2)	664/2259 (29.4)	129/1353 (9.5)	905 (13.6)	253 (15.9)	2316/15,137 (15.3)
>4 mo	169 (5.2)	154/2259 (6.8)	38/1353 (2.8)	315 (4.7)	100 (6.3)	776/15,137 (5.1)

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TABLE 1. Continued

Variable	Clinic A (n=3269)	Clinic B (n=2512)	Clinic C (n=1403)	Clinic D (n=6668)	Clinic E (n=1588)	All travelers (N=15,440)
Travel accommodation (more than one accommodation possible)						
Hotel or hostel	3379/4318 (78.3)	1470/2624 (56.0)	1629/1880 (86.6)	3899/5632 (69.2)	1149/1661 (69.2)	11,526/16,115 (71.5)
Home/local residence	1407/4318 (32.6)	1365/2624 (52.0)	483/1880 (25.7)	1329/5632 (23.6)	577/1661 (34.7)	5161/16,115 (32.0)
Tent	481/4318 (11.1)	157/2624 (6.0)	151/1880 (8.0)	355/5632 (6.3)	125/1661 (7.5)	1269/16,115 (7.9)
Other	291/4318 (6.7)	0 (0)	163/1880 (8.7)	420/5632 (7.5)	118/1661 (7.1)	992/16,115 (6.2)

[a]IQR = interquartile range; US = United States.
[b]Data are presented as No. (percentage) of travelers unless indicated otherwise. Denominators are provided when data were not available for all travelers. Percentages may not total 100 because of rounding.
[c]Data presented as No. of travelers/No. of reasons. More than one reason is possible.

RESULTS

Traveler Characteristics

The median age of the 15,440 travelers was 34 years (IQR, 24-51 years); 1731 (11.2%) were aged 18 years or younger (Table 1). More travelers were female (8730 of 15,439 [56.5%]), 72.4% (10,528 of 14,545) were white, and for 86.8% (12,314 of 14,180), English was the primary language. There were notable differences across sites. A greater proportion of travelers seen at Clinic B were black and Hispanic, and more Clinic E travelers were Asian. Almost 40% (893 of 2296 [38.9%]) of Clinic B travelers and 30.7% (250 of 815) of Clinic E travelers were born outside the United States, and 19.5% (490 of 2512), 17.1% (1141 of 6668), and 13.5% (141 of 1044) of those seen at Clinics B, D, and E, respectively, were not native English speakers. Roughly a fifth of travelers seen at Clinics B and E were aged 18 years or younger; pediatric patients were seen less frequently at the other BATMN clinics. Clinic C travelers tended to be older; 14.3% (201 of 1403) were 65 years or older. In contrast, Clinic A provided pretravel services for a predominantly white, young and middle-aged adult population.

Trip Characteristics

Purpose of travel was tourism for 55.5% (8251 of 15,360) and VFR for 18.7% (2876 of 15,360; range, 7.6% [184 of 2436] to 39.0% [1029 of 2639]). Clinics B and E had a large proportion of VFR travelers (39.0% [1029 of 2639] and 24.1% [415 of 1725], respectively), and more Clinic B travelers were traveling for research/education (411 of 2639 [15.6%]). Clinics B and E had fewer business travelers relative to the other sites. Travelers were seen a median of 23 days before travel (IQR, 12-40 days); 29.4% (3077 of 10,483) were seen less than 2 weeks before departure, including 12.3% (1293 of 10,483) who were seen within a week and 2.7% (283 of 10,483) within 2 days before departure (although at Clinic C, 119 of 1368 travelers [8.7%] were seen within 2 days of travel). Median trip duration was 15 days (IQR, 10-29 days) but was significantly longer at Clinic B (21 days) relative to other sites ($P<.001$). Most travelers planned to stay in a hotel, home, or hostel, although proportions varied widely; 7.9% (1269 of 16,115) anticipated staying in tents.

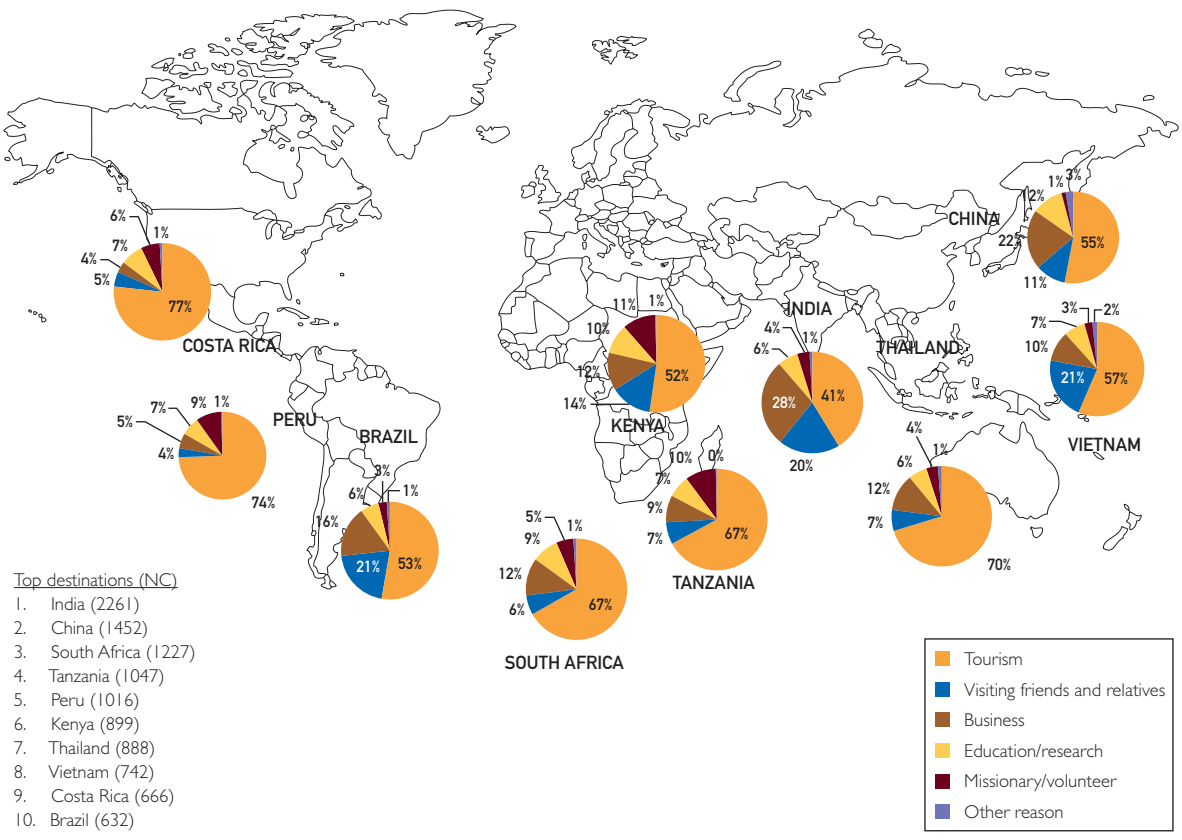

FIGURE 1. Top 10 most frequent destinations reported by Boston-area international travelers from 2008 to 2010, stratified by purpose of travel.

Major Destinations

The top 10 destinations were India, China, South Africa, Tanzania, Peru, Kenya, Thailand, Vietnam, Costa Rica, and Brazil (Figure 1). Business travelers more commonly visited India and China. The VFR travelers visited, in order of frequency, Vietnam, Brazil, India, Haiti, Kenya, and China. Clinic B had 3 African countries (Nigeria, Kenya, and Ghana) among its top 5 destinations (Table 2), while Clinic E had a greater proportion of travelers to Asia (India, China, Vietnam, and Thailand).

Traveler and Trip Characteristics Stratified by Purpose of Travel

In all clinics, more women than men traveled for research/education or missionary/volunteer work (69% vs 31%, $P<.001$; and 65% vs 35%, $P<.001$, respectively), whereas more business travelers were male (59%, $P<.001$) (Table 3). Research/education and missionary/volunteer travelers were younger than business travelers (median ages, 22 and 27 years vs 40 years). More VFR travelers were black ($P<.001$), Asian ($P<.001$), or Hispanic ($P<.001$) than white, compared with those traveling for other reasons. Median interval until departure was shortest among VFR and business travelers (19 and 18 days, respectively) and longest for research/education travelers (29 days). Research/education travelers also had the longest median trip duration (33.5 days). The VFR travelers were more likely to stay at a home or local residence (2196 of 2976 [73.8%]; $P<.001$) compared with other travelers.

Travel to Malaria, YF, and Typhoid Risk Destinations

Travel to malaria risk countries varied by clinic, ranging from 23.7% (333 of 1403) for Clinic C to 52.0% (1306 of 2512) for

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Clinic B (Table 2). Clinic B travelers were also more likely to travel to YF risk countries (47.6% [1196 of 2512]) compared with travelers at other clinics (24.5% [344 of 1403] to 32.8% [521 of 1588]; $P<.001$). The proportions of travelers to areas with typhoid risk ranged from 8.0% (156 of 2512) to 16.3% (228 of 1403).

Prescriptions for Traveler's Diarrhea Self-treatment and Malaria Chemoprophylaxis

Prescriptions for traveler's diarrhea (TD) self-treatment medications were given to 13,261 of the 15,440 travelers (85.9%); 285 travelers received more than one prescription. Adults were prescribed TD self-treatment more frequently than children (87.7% [12,187 of 13,895] vs 69.5% [1074 of 1545]; $P<.001$), and proportions given TD prescriptions varied by destination and clinic. Travelers received TD self-treatment more frequently for trips to Oceania, Eastern Europe, and Asia (92% [5146 of 5591]) to 96.8% [153 of 158] than Africa (81.4% [4344 of 5377]). Ciprofloxacin was prescribed most frequently (60.0% [9239 of 15,400]), followed by azithromycin (30.6% [4710 of 15,403]), levofloxacin (4.1% [492 of 12,124]), and rifaximin (0.2% [24 of 10,563]). Azithromycin was prescribed more frequently than ciprofloxacin for travelers to Asia (Figure 2). Of 1602 children, 1160 (72.4%) received an antibiotic for TD, 105 of whom (9.1%) were prescribed a fluoroquinolone.

Antimalarial medications were prescribed for 10,431 travelers, most commonly those traveling to Africa and Asia (Figure 3). Atovaquone-proguanil was prescribed for 67.3% (7015), chloroquine for 12.9% (1349), mefloquine for 14.6% (1524), doxycycline for 5.0% (519), and primaquine for 0.2% (24). Atovaquone-proguanil and chloroquine were the most commonly prescribed antimalarials for travelers to Central and South America/Caribbean/Mexico. Among 1545 pediatric travelers (<18 years), atovaquone-proguanil was prescribed most often (469 [30%]), followed by mefloquine (342 [22%]). Mefloquine use varied substantially by clinic, ranging from 6% (138 of 2222), to 41% (648 of 1588) of antimalarial prescriptions; it was prescribed more often for VFR (743 of 2812 [26%]) than non-VFR (776 of 12,628 [6%]) travelers.

TABLE 2. Top 5 Destinations and Proportion of Travelers to High-Risk Countries, Stratified by Boston Area Travel Medicine Clinic Attended Before Trip Departure (March 2008–July 2010)

Variable	No. (%) of travelers					
	Clinic A (n=3269)	Clinic B (n=2512)	Clinic C (n=1403)	Clinic D (n=6668)	Clinic E (n=1588)	All travelers (N=15,440)
Top 5 destinations[a]	India 588 (18.0)	Nigeria 231 (9.2)	India 269 (19.2)	India 994 (14.9)	India 229 (14.4)	India 2261 (14.6)
	South Africa 353 (10.8)	India 181 (7.2)	China 241 (17.2)	China 627 (9.4)	China 145 (9.0)	China 1452 (9.4)
	China 3347 (10.6)	Kenya 181 (7.2)	Peru 173 (12.3)	South Africa 520 (7.8)	Vietnam 127 (8.0)	South Africa 1227 (7.9)
	Tanzania 301 (9.2)	Haiti 131 (5.2)	South Africa 145 (10.3)	Tanzania 440 (6.6)	Thailand 106 (6.7)	Tanzania 1047 (6.8)
	Peru 275 (8.4)	Ghana 124 (4.9)	Tanzania 130 (9.3)	Thailand 380 (5.7)	Peru 97 (6.1)	Peru 1016 (6.6)
Travel to high-risk countries						
Malaria risk[b]	1098 (33.6)	1306 (52.0)	333 (23.7)	2120 (31.8)	519 (32.7)	5373 (34.8)
Typhoid fever high risk[c]	510 (15.6)	201 (8.0)	339 (16.3)	1067 (16.0)	224 (14.1)	2223 (14.4)
Yellow fever risk[d]	932 (28.5)	1200 (47.6)	344 (24.5)	2114 (31.7)	521 (32.8)	5113 (33.1)

[a]More than one destination possible.
[b]Malaria (total/partial/none) risk destination countries were assigned according to Centers for Disease Control and Prevention classifications, corresponding to our study period. Proportions are for countries with total malaria risk.[15]
[c]Countries with typhoid risk were categorized as high (>100 annual cases/100,000 person-years), medium (10-100/100,000 person-years), and low risk (<10/100,000 person-years).[16]
[d]Yellow fever (holoendemic/partially endemic/none) risk destination countries were assigned according to Centers for Disease Control and Prevention classifications, corresponding to our study period. Proportions are for countries with holoendemic yellow fever risk.[15]

TABLE 3. Demographic and Trip Characteristics for Travelers Attending Boston Area Travel Medicine Clinics Before Departure (March 2008-July 2010), Stratified by Purpose of Travel[a,b]

Variable	Tourism (n=7399)	Visiting friends and relatives (n=2812)	Business (n=2111)	Education/ research (n=1281)	Missionary/volunteer (n=1516)	Other reason[c] (n=241)	No response (n=1374)	All purposes (N=16,734)
Traveler characteristics								
Female	4156/7398 (56.2)	1544 (55.0)	872 (41.3)	888 (69.3)	984 (64.9)	123 (51.0)	821 (59.8)	9388/16,733 (56.1)
Age (y)								
Median (IQR)	37 (26-55)	33 (22-48)	40 (30-51)	22 (20-28)	27 (21-42)	40 (29-48)	38 (27-55)	34 (24-51)
<1	5 (0.1)	43 (1.5)	0 (0)	0 (0)	0 (0)	1 (0)	2 (0.1)	51 (0.3)
1 to <2	20 (0.3)	71 (2.5)	0 (0)	0 (0)	0 (0)	2 (0.8)	4 (0.3)	97 (0.6)
2-10	161 (2.2)	(11.0)	3 (0.1)	2 (0.2)	6 (0.4)	10 (4.1)	21 (1.5)	513 (3.1)
11-18	544 (7.4)	186 (6.6)	14 (0.7)	202 (15.8)	242 (16.0)	10 (4.1)	24 (1.7)	1222 (7.3)
19-64	5938 (80.3)	2044 (72.7)	2006 (95.0)	1061 (82.8)	1226 (80.9)	203 (84.2)	1179 (85.8)	13,657 (81.6)
≥65	730 (9.9)	158 (5.6)	88 (4.2)	16 (1.2)	42 (2.8)	15 (6.2)	143 (10.4)	1192 (7.1)
Race/ethnicity								
Asian	575/6955 (8.3)	575/2691 (21.4)	122/1980 (6.2)	98/1208 (8.1)	83/1434 (5.8)	24/236 (10.2)	106/1284 (8.3)	1583/15,788 (10.0)
Biracial/multiracial	86/6955 (1.2)	67/2691 (2.5)	22/1980 (1.1)	29/1208 (2.4)	28/1434 (2.0)	5/236 (2.1)	5/1284 (0.4)	242/15,788 (1.5)
Black	326/6955 (4.7)	1000/2691 (37.2)	94/1980 (4.7)	70/1208 (5.8)	100/1434 (7.0)	35/236 (14.8)	141/1284 (11.0)	1766/15,788 (11.2)
Hispanic/Latino	160/6955 (2.3)	183/2691 (6.8)	50/1980 (2.5)	40/1208 (3.3)	49/1434 (3.4)	4/236 (1.7)	42/1284 (3.3)	528/15,788 (3.3)
White	5715/6955 (82.2)	765/2691 (28.4)	1661/1980 (83.9)	958/1208 (79.3)	1150/1434 (80.2)	157/236 (66.5)	950/1284 (74.0)	11,356/15,788 (71.9)
Other	91/6955 (1.3)	101/2691 (3.8)	31/1980 (1.6)	13/1208 (1.1)	24/1434 (1.7)	11/236 (4.7)	39/1284 (3.0)	310/15,788 (2.0)
Primary language English	5897/6618 (89.1)	1920/2614 (73.5)	1704/1916 (88.9)	1069/1181 (95.6)	1282/1410 (90.9)	180/220 (81.8)	1221/1315 (92.9)	13,273/15,274 (86.9)
Born in the US	5638/6802 (82.9)	1278/2624 (48.7)	1643/1996 (82.3)	1020/1177 (86.7)	1195/1407 (84.9)	146/217 (67.3)	663/925 (71.7)	11,583/15,148 (76.5)
At least one parent's country of origin not US	1693/5722 (29.6)	1530/2016 (75.9)	485/1724 (28.1)	244/937 (26.0)	325/1176 (27.6)	85/187 (45.5)	230/684 (33.6)	4592/12,446 (36.9)
Time to departure								
Median, d (IQR)	25 (14-43)	19 (10-33)	18 (9-32)	29 (16-47)	24 (13-42)	26 (14-43)	21 (10-33)	23 (12-40)
0-6 d	534/5326 (10.0)	335/2189 (15.3)	283/1488 (19.0)	95/991 (9.6)	123/1160 (10.6)	13/164 (7.9)	21/197 (10.7)	1404/11,515 (12.2)
7-13 d	782/5326 (14.7)	452/2189 (20.6)	303/1488 (20.4)	127/991 (12.8)	189/1160 (16.3)	24/164 (14.6)	49/197 (24.9)	1926/11,515 (16.7)
2-4 wk	1535/5326 (28.8)	648/2189 (29.6)	440/1488 (29.6)	248/991 (25.0)	320/1160 (27.6)	51/164 (31.1)	52/197 (26.4)	3294/11,515 (28.6)
<1-4 mo	2379/5326 (44.7)	727/2189 (33.2)	451/1488 (30.3)	502/991 (50.7)	503/1160 (43.4)	71/164 (43.3)	72/197 (36.5)	4705/11,515 (40.9)
>4 mo	91/5326 (1.7)	26/2189 (1.2)	7/1488 (0.5)	18/991 (1.8)	24/1160 (2.1)	5/164 (3.0)	3/197 (1.5)	174/11,515 (1.5)
Trip duration								
Median, d (IQR)	14.0 (10-21)	21.0 (14-32)	14.0 (8-29)	33.5 (15-98)	14.0 (9-30)	21.0 (14-99)	14.0 (11-25)	15.0 (11-30)
<2 wk	3836/7323 (52.4)	826/2746 (30.0)	1181/2069 (57.1)	298/1258 (23.7)	760/1497 (50.8)	77/230 (33.5)	650/1276 (50.9)	7628/16,399 (46.5)
2-4 wk	2547/7323 (34.8)	1151/2746 (41.9)	444/2069 (21.5)	291/1258 (23.1)	387/1497 (25.9)	70/230 (30.4)	387/1276 (30.3)	5277/16,399 (32.2)
<1-4 mo	757/7323 (10.3)	667/2746 (24.3)	277/2069 (13.4)	464/1258 (36.9)	256/1497 (17.1)	26/230 (11.3)	159/1276 (12.5)	2606/16,399 (15.9)
>4 mo	183/7323 (2.5)	102/2746 (3.7)	167/2069 (8.1)	205/1258 (16.3)	94/1497 (6.3)	57/230 (24.8)	80/1276 (6.3)	888/16,399 (5.4)

Continued on next page

TABLE 3. Continued

Variable	Tourism (n=7399)	Visiting friends and relatives (n=2812)	Business (n=2111)	Education/ research (n=1281)	Missionary/volunteer (n=1516)	Other reason[c] (n=241)	No response (n=1374)	All purposes (N=16,734)
Travel accommodation[d]								
Hotel or hostel	6820/7979 (85.5)	1159/2976 (38.9)	1776/2087 (85.1)	790/1362 (58.0)	798/1571 (50.8)	169/245 (69.0)	1270/1528 (83.1)	12,782/17,748 (72.0)
Home/local residence	1542/7979 (19.3)	2196/2976 (73.8)	405/2087 (19.4)	548/1362 (40.2)	592/1571 (37.7)	88/245 (35.9)	493/1528 (32.3)	5864/17,748 (33.0)
Tent	836/7979 (10.5)	44/2976 (1.5)	57/2087 (2.7)	63/1362 (4.6)	210/1571 (13.4)	10/245 (4.1)	129/1528 (8.4)	1349/17,748 (7.6)
Other	445/7979 (5.6)	29/2976 (1.0)	72/2087 (3.4)	210/1362 (15.4)	202/1571 (12.9)	5/245 (2.0)	92/1528 (6.0)	1055/17,748 (5.9)

[a]IQR = interquartile range; US = United States.
[b]Data are presented as No. (percentage) of travelers unless indicated otherwise. Denominators are provided when data were not available for all travelers. Percentages may not total 100 because of rounding.
[c]Seven for adoption, 32 for moving, 7 for a religious pilgrimage, and 195 not stated.
[d]More than one accommodation possible.

Selected Immunizations

Of the 2080 travelers to India, 1979 (95.1%; range, 78.3% [141 of 180] to 98.1% [471 of 480]) were immunized against typhoid, and 473 of 520 travelers to Ghana (91.0%; range, 73.4% [91 of 124] to 97.7% [215 of 220]) were given YF vaccine (Table 4). Use of influenza vaccine (during the visit or current influenza season) for travelers to China varied widely, ranging from 4.4% (4 of 91) to 65.7% (132 of 201). Although most travelers to Nigeria were given a polio booster, a lower percentage at Clinic B received this vaccine (69.4% [102 of 147] vs 82.0% [41 of 50] to 100% [47 of 47 and 6 of 6] at the other clinics).

Preventive Counseling

Advice on preventing TD, malaria, and other vector-borne diseases was usually provided to travelers at all clinics (13,397 of 13,580 [98.7%], 11,551 of 13,579 [85.1%], and 11,307 of 11,656 [97.0%], respectively) (Supplemental Table, available online at http://www.mcpiqojournal.org). Counseling on animal bite prevention and management of potential rabies exposure varied from 55.9% (780 of 1395) to 92.7% (1962 of 2116). Greater variability existed in provision of advice on preventing sexually transmitted infections (12.8% [179 of 1396] to 84.1% [5595 of 6655] between Clinics C and D, respectively).

DISCUSSION

We found a wide range of types of travelers and trip characteristics at different travel medicine practices in the greater Boston metropolitan area. Although some clinics provided services mostly to white, English-speaking people traveling for tourism and business, others had more black, Hispanic, Asian, and VFR travelers. These data indicate that substantial differences in clinic populations can occur within a metropolitan area, highlighting that travel clinics need to develop expertise and target pretravel interventions to the travelers they serve.

Timing of travel clinic appointments had a direct influence on providing itinerary-specific immunizations. Business and VFR travelers often had appointments 3 weeks or less before

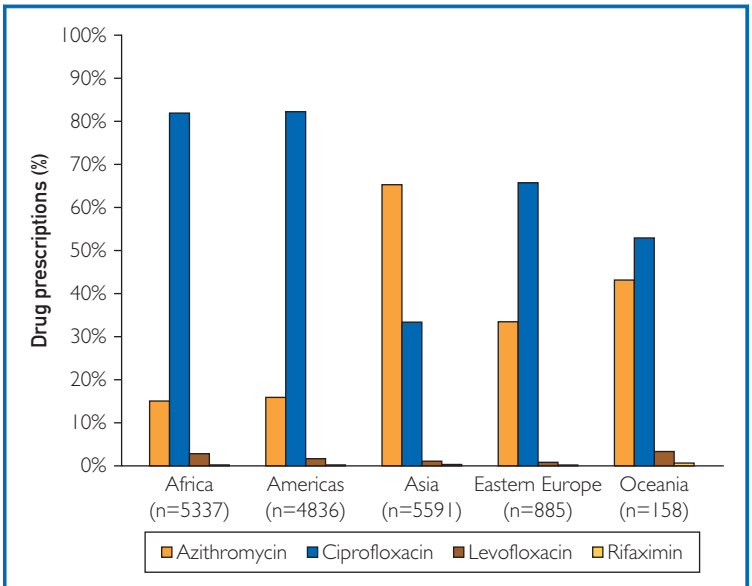

FIGURE 2. Proportion of antibiotics for self-treatment of traveler's diarrhea prescribed by Boston Area Travel Medicine Network clinics from 2008 to 2010, stratified by region.

travel. Travelers at Clinic C were frequently seen only days before travel and thus, like business and VFR travelers, faced potential constraints for receipt of multidose vaccines such as rabies and Japanese encephalitis, which require 3 to 4 weeks for completion.[17] In contrast, those traveling for research/education or missionary/volunteer work typically were seen with sufficient time to complete these vaccines. Business and VFR travelers, who may experience cumulative risk of travel-associated illness due to repeated travel, may benefit from information about the need for sufficient time pretravel for evaluation, vaccination, and other medical preparations.[18] Business travelers also may need to make frequent short trips and may be able to obtain multidose vaccines in stages in order to complete a vaccine series.[19] Physicians seeing a large number of business travelers could provide educational material to local businesses to encourage clinic visits at least a month before travel. These communications need to emphasize the importance of returning to complete the vaccine series. Building a travel clinic visit into a business traveler's administrative checklist (passport, visa, airplane tickets) could also be an effective strategy.

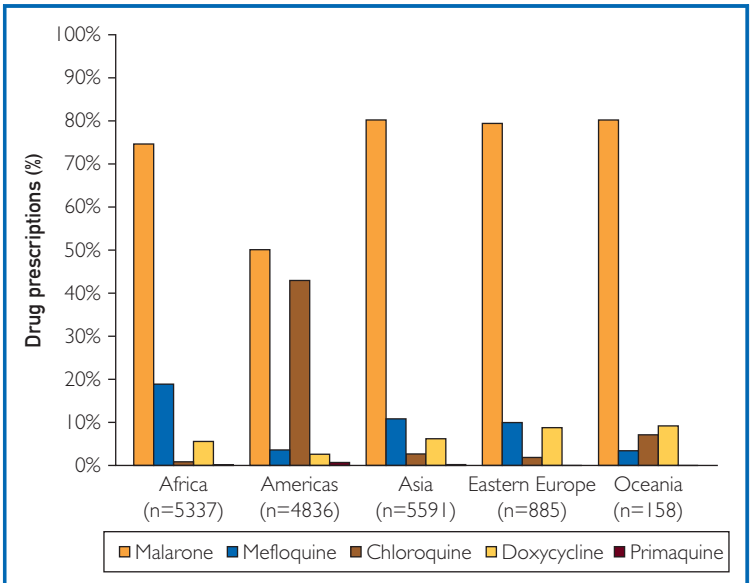

FIGURE 3. Proportion of antimalarials prescribed for chemoprophylaxis by Boston Area Travel Medicine Network clinics from 2008 to 2010, stratified by region.

Traveler's diarrhea has been reported repeatedly to be the most common health problem associated with travel.[7-9,20,21] Despite pretravel advice, TD remains a common ailment and concern.[22] We found that 98.7% (13,397 of 13,580 travelers) of pretravel consultations provided counseling on diarrhea prevention and management, and most travelers received TD self-treatment prescriptions. The main antibiotics recommended for TD are fluoroquinolones and macrolides. Recently, numerous studies have reported the increased acquisition of extended-spectrum β-lactamase and multidrug-resistant Enterobacteriaceae in travelers who have taken antibiotics for TD self-treatment compared with those who did not.[23-25] Consequently, TD self-treatment has become more challenging. Clinicians must advise travelers of antibiotic-associated medication adverse effects and possible acquisition of drug-resistant organisms but balance this with teaching about appropriate use of TD self-treatment, especially in countries where appropriate treatment and medications may be unavailable. Our results illustrate practices common in 2008 to 2010 and may be useful for comparison as travel medicine specialists and travelers limit use of antibiotics to the treatment of severe TD in the future.

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TABLE 4. Pretravel Vaccinations for Specific High-Risk Locations Among Travelers Seen at Boston Area Travel Medicine Clinics Before Trip Departure (March 2008-July 2010)[a]

Variable	Clinic A	Clinic B	Clinic C	Clinic D	Clinic E	All travelers
Travelers to India, typhoid fever vaccine	471/480 (98.1)	141/180 (78.3)	201/222 (90.5)	979/995 (98.4)	187/203 (92.1)	1979/2080 (95.1)
Travelers to Ghana, yellow fever vaccine	77/79 (97.5)	91/124 (73.4)	25/27 (92.6)	215/220 (97.7)	65/70 (92.9)	473/520 (91.0)
Travelers to China, influenza vaccine	178/283 (62.9)	4/91 (4.4)	132/201 (65.7)	290/627 (46.3)	55/130 (42.3)	659/1332 (49.5)
Adult travelers to Nigeria, polio immunization	47/47 (100)	102/147 (69.4)	6/6 (100)	80/82 (97.6)	41/50 (82.0)	276/332 (83.1)

[a]Data are presented as No. (percentage) of travelers. Vaccination percentage includes documented history of past immunization or seropositivity as well as current immunizations.

Almost one-third of travelers visited countries with malaria risk in at least part of the country. Almost 70% of travelers (7015 of 10,431 [67.3%]) were prescribed atovaquone-proguanil, likely because of its availability and safety profile. It was the most common antimalarial drug prescribed for all regions except Central America/Caribbean, where chloroquine, still effective, accounted for almost half of the prescriptions. More frequent prescription of mefloquine for VFR travelers may reflect cost considerations, trip duration, pediatric traveler volume, destination, traveler preferences, and prior use and familiarity with the drug. Data collected for this study preceded the strengthened and updated US Food and Drug Administration black box warnings about potential long-lasting neurologic adverse effects from mefloquine issued in July 2013,[26] but concerns had been raised in the literature before 2013.[27] Physician and traveler experiences and preferences influence chemoprophylaxis choices, including consideration of insurance coverage, comorbidities, concomitant medications, cost, and medication shortages.

Our findings suggest that vaccination recommendations for and/or uptake by travelers vary widely depending on clinic population. For example, high proportions of travelers from Clinic B went to countries with YF, but YF vaccination rates were relatively low. This may have been due to past YF immunization not documented during the data collection process, despite attempts to incorporate prior vaccination data into the study analysis. Completion rates for vaccinations may reflect traveler characteristics, such as age and comorbidities, that affect vaccine safety; logistic factors including cost and visit timing before travel; and knowledge/attitudes about disease risk, adverse reactions, and vaccine efficacy.[10,11,28] Low vaccination uptake, such as for polio among travelers to Nigeria, may also reflect missed documentation of prior immunization (or perception that repeated vaccination is unnecessary). Accessing previous vaccination information may be particularly difficult for travelers born outside the United States. Guidelines state that physicians should administer polio vaccinations to travelers to selected countries when vaccination status is unknown.[29] Individualized discussions between physician and traveler regarding cost, risks, and benefits are needed to inform vaccination decision making and ensure that travelers are protected adequately.[30,31]

The VFR travelers made up a substantial portion of travelers in this study. Our results can be used to improve travel advice to VFR travelers. Many VFR travelers were children; clinics that see many VFR travelers need to be prepared to provide pretravel consultations to children as well as adults. The VFR travelers were often seen within 2 weeks of departure; physicians should be familiar with accelerated schedules for vaccines or recommend ways for travelers to obtain their next dose of a vaccine series on return from this trip but before the next. More VFR travelers spoke a language other than English or were born outside the United States, suggesting possible lack of familiarity with travel medicine as a

specialty. All VFR travelers need to be aware of and understand the need for pretravel health consultations. Clinics seeing VFR travelers may need to partner with primary care physicians and other specialists to ensure that appropriate services are provided within the primary care system or referrals are made to travel medicine clinics, especially for high-risk travelers. Travel medicine experts, especially those who see large volumes of travelers and have completed formal certification processes,[32] are in a position to provide to primary care clinicians information and education targeted toward appropriate traveler populations. Communities with many VFR travelers may need to use innovative community-based services (radio programs, church or school announcements, partnering with agencies working with immigrants) to inform VFR travelers about travel medicine services and where they can obtain them.[33]

Three major strengths of this study are the large sample size, study period covering more than 2 full years of pretravel visits, and diversity of travelers seen in the BATMN clinics. Limitations include focus on travelers from just one metropolitan area in the United States; missing responses for certain key variables, including purpose of trip and trip duration; inability to analyze malaria chemoprophylaxis based on specific regions within a country; lack of data on reasons vaccines were not administered (eg, refusals due to unwillingness to pay); gaps in documentation on counseling for certain topics; and variations in practices of travel medicine health care professionals at the 5 BATMN clinics. The differences in practice may have been influenced by level of experience and whether the physicians at our sites had been certified, because these factors have been associated with better knowledge and practices.[32] Because our data were collected from 2008 to 2010, they may not reflect current practices. Nevertheless, our findings are strikingly similar to those of Global TravEpiNet, which evaluated travelers from 18 travel clinics across the United States and found a mean age of 35 years (range, 1 month to 94 years), 54% female, median travel duration of 14 days, and pretravel consultation occurring 24 days before departure.[10] Despite these similarities between the national cohort of travelers from Global TravEpiNet and BATMN clinics, our data highlight the variation that can occur among travel clinics and emphasize the need to address these variations in clinical practice.

CONCLUSION

This study revealed major differences in travelers and trip characteristics across travel clinics in the same city. Understanding the profile of the travelers at a facility can improve understanding of a clinic population's travel-associated risks. Travel medicine specialists can use these characteristics to optimize referrals to their travel clinics, incorporate cultural awareness into their counseling approaches, target travel medicine education of clinicians and trainees, make appropriate vaccines available, and educate patients on when to seek advice about travel.

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The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the CDC.

SUPPLEMENTAL ONLINE MATERIAL

Supplemental material can be found online at http://www.mcpiqojournal.org. Supplemental material attached to journal articles has not been edited, and the authors take responsibility for the accuracy of all data.

Abbreviations and Acronyms: **BATMN** = Boston Area Travel Medicine Network; **CDC** = Centers for Disease Control and Prevention; **IQR** = interquartile range; **TD** = traveler's diarrhea; **VFR** = visiting friends and relatives; **YF** = yellow fever

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Potential Competing Interests: Dr Hamer is a member of the iJet International, Inc, health advisory board; is a consultant to Valneva SE; and has received honoraria from DynaMed (EBSCO Industries, Inc) and Elsevier. Dr Hochberg is a consultant to PaxVax Corporation. Dr Chen is an advisor for Shoreland, Inc; has received speaker travel support and honoraria from GlaxoSmithKline plc; and serves on the data safety monitoring board for a vaccine in development by Valneva SE. Dr Kogelman is a member of the Gilead advisory board and speaker's bureau. Dr Barnett has received research funding from PaxVax Corporation and Valneva SE; serves on the data safety monitoring board for a vaccine in development by Pfizer Inc; and has served as a consultant to PaxVax Corporation and Romark, LC (Alinia). The rest of the authors report no competing interests.

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