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## Travel to Brazil: Analysis of Data From the Boston Area Travel Medicine Network (BATMN) and Relevance to Travelers Attending World Cup and Olympics

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### Abstract

We describe travelers who were evaluated pre-travel to Brazil from March 2008 through July 2010 in the Boston area. Of 599 Brazil travelers, 71%, 58%, and 50% received vaccines for yellow fever (YF), typhoid, and hepatitis A, respectively. Fewer received influenza and hepatitis B vaccines (14%, 11%). A total of 60% traveled during Brazil's peak influenza season, and one fourth visited during peak dengue transmission. The 2014 World Cup and 2016 Olympics include events throughout Brazil. Travelers should seek pre-travel assessment including YF and malaria risk; travelers should be vaccinated against influenza, be up to date on other routine vaccines, and be prepared to protect themselves against mosquitoes.

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Brazil is a popular tourist destination. International visitors are expected to increase as Brazil hosts the 2014 FIFA World Cup™ and the 2016 Olympics/Paralympics, each drawing ~600,000 international tourists and athletes (FIFA:<http://www.fifa.com/worldcup/news/newsid=1663917/index.html>. Last accessed December 20, 2013).<sup>1</sup>

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Brazil has reduced or eliminated many vaccine-preventable diseases, diarrheal diseases, and childhood pneumonia.<sup>2</sup> Despite these gains, other infectious disease challenges remain.<sup>2</sup> Malaria programs have reduced the number of malaria cases, but risk remains in the Amazon region.<sup>2</sup> Dengue has become a major public health problem, with annual incidence nearing 400 cases/100,000 population.<sup>2</sup> Yellow fever (YF) virus transmission areas have also expanded.

US residents constituted 12.4% of visitors to Brazil in 2010<sup>3</sup> and a large Brazilian population resides in metropolitan Boston.<sup>4</sup> We describe pre-travel preparation of Boston-area travelers to provide an understanding of potential travelers to Brazil in advance of the upcoming mass gathering events.

## Methods

The Boston Area Travel Medicine Network (BATMN), a research collaboration of five Boston-area travel clinics, collected demographic data, medical history, trip information, and interventions provided for travelers from March 1, 2008 through July 31, 2010. Institutional review board (IRB) approvals were obtained at all clinic sites. The US Centers for Disease Control and Prevention (CDC) determined that CDC's participation did not require IRB review.

Travelers to Brazil included two subsets: those who planned to visit solely Brazil (Brazil-only travelers) and those who planned to visit Brazil plus other Latin American destinations. We defined Latin America as Mexico and all countries in Central and South America; Caribbean countries were excluded.

YF and malaria risks were based on maps published in CDC's Health Information for International Travel 2010,<sup>5</sup> and dengue incidence was provided by the Brazilian Ministry of Health.<sup>6</sup> For malaria chemoprophylaxis, we analyzed Brazil travelers overall and further analyzed Brazil-only travelers in detail.

We summarized characteristics using means and interquartile ranges (IQRs) for continuous variables and frequencies for discrete variables. We compared means of continuous variables using *t*-test. All analyses were performed using SAS version 9.1.3 (SAS Institute Inc., Cary, NC, USA).

## Results

Of 15,442 total travelers seen in BATMN clinics, 4,035 travelers planned to visit Latin America: 599 (4% of total) travelers had destinations including Brazil. Of these 599, 369 (62%) were Brazil-only travelers, whereas 230 (38%) visited Brazil and another Latin American destination. Brazil was the 10th most common international destination overall and third most common Latin American destination, after Peru and Costa Rica.

Of 599 Brazil travelers, 47% were male, mean age was 33 years and 8% reported country of origin as Brazil (Table 1). Although 59% of travelers planned to stay in a hotel, 31%

reported staying in a home/local residence. Common purposes of travel included tourism (51%), visiting friends and relatives (VFR; 21%), and business (14%).

Of 595 Brazil travelers, 232 (39%) received malaria chemoprophylaxis. Of 369 Brazil-only travelers, 110 (30%) received malaria chemoprophylaxis; atovaquone/proguanil was prescribed most commonly (32%). Longer trip duration was marginally associated with choice of malaria chemoprophylaxis ( $p = 0.06$ ). Trip duration was longer by 49 days (95% CI: 14.8–83.3) for travelers prescribed mefloquine/chloroquine than for those receiving atovaquone/proguanil.

Of all Brazil travelers, 85% were prescribed self-treatment for travelers' diarrhea (primarily ciprofloxacin; Table 1). Of the 599 Brazil travelers, 71%, 58%, and 50% received vaccines for YF, typhoid, and hepatitis A at their visit, respectively. Vaccines administered less frequently were for influenza (14%), hepatitis B (11%), and rabies (3%).

The most common risk prevention topics discussed with Brazil travelers were vector-borne disease avoidance (98%) and fresh water exposure (96%). Blood/body fluid exposure (73%), medical evacuation insurance (72%), and sexually transmitted infections (68%) were discussed less frequently.

Among Brazil-only travelers whose dates of travel were available ( $N = 167$ ), popular travel times were June–August (47%) and April (13%). One fourth ( $N = 44$ ) planned travel during March–May (peak dengue transmission) and two thirds ( $N = 112$ ) planned visits during April–August (high influenza circulation).

## Discussion

Brazil is a challenge for travel medicine providers because of diverse transmission zones of several vector-borne infections. Clinicians preparing travelers for mass gathering events will need to consider these areas closely. Malaria, predominantly *Plasmodium vivax* (>75%) along with chloroquine-resistant *Plasmodium falciparum*, is present in the Amazon region.<sup>5</sup> Less than one third of Brazil-only travelers were prescribed malaria chemoprophylaxis, demonstrating the predominance of travel to areas without risk. Despite chemoprophylaxis, *P. vivax* remains possible because chemoprophylaxis primarily targets *P. falciparum*. While Brazil reports few human YF cases, YF is endemic in wide areas and YF vaccine is recommended except when visiting only eastern coastal areas.<sup>5,7</sup> Brazil travelers in this study had high YF vaccination rates, consistent with Brazil's large YF-endemic zone. Currently, Brazilian authorities report to WHO that there is no YF vaccine requirement for entry into Brazil. However, countrywise entry requirements may vary and are subject to change at any time [eg, see requirements per Brazilian Consulate in Paris (<http://cgparis.itamaraty.gov.br/fr/vaccination.xml>); translated from Portuguese. Last accessed February 12, 2014)]. Travelers should check entry requirements from Brazilian authorities in their own countries and the Brazilian Ministry of Health before travel.

Dengue fever incidence has increased in Brazil in the past two decades, with 3.5 million cases from 2000 to 2009.<sup>2</sup> A recent study estimated 5.3 million dengue infections in Brazil in 2010.<sup>6,8</sup> The vector mosquitoes, *Aedes aegypti* and *Aedes albopictus*, are widely

distributed, and major outbreaks have occurred in cities including Rio de Janeiro.<sup>9</sup> Dengue transmission occurs year-round but usually peaks March–May.<sup>6</sup> The Olympic Games/ Paralympics will occur mainly in Rio de Janeiro, although some events will occur in YF-endemic areas (Belo Horizonte and Brasília).<sup>10</sup> The World Cup locations will include YF- or malaria-endemic areas (Belo Horizonte, Brasília, Cuiabá, Manaus, and Porto Alegre for YF, and Cuiaba and Manaus for malaria).<sup>10</sup> Nonetheless, all travelers to Brazil, including those attending the World Cup or Olympics, should take precautions against mosquitoes.

Food- and water-borne diseases have declined significantly in Brazil.<sup>11</sup> Hepatitis A immunization rates were high among BATMN travelers (89% overall—39% immunized in the past and 50% at travel clinic visits included in this analysis). Typhoid vaccines were administered to over half the travelers at travel clinic visits, reflecting a perception of moderate risk (143 cases reported in Brazil in 2010).<sup>12,13</sup>

Many Brazil travelers were tourists staying in hotels or hostels for less than 2 weeks, though one fifth were VFRs and one third planned to stay in a home/local residence. More than one third planned to visit other Latin American countries, potentially increasing their disease risks.

Pre-travel consultation represents an opportunity for travelers to receive routine vaccines such as influenza and hepatitis B. Influenza is the most common vaccine-preventable disease in travelers but only few travelers received influenza vaccine at their pre-travel visit.<sup>14</sup> In southern Brazil, April–August is the influenza epidemic season, whereas northern Brazil has transmission year-round.<sup>15</sup> Most (60%) travelers in our cohort planned to visit in June–September—when influenza incidence declines in the northern hemisphere, awareness wanes, and vaccine may not be available. The Olympics (August–September 2016) will coincide with peak influenza circulation. Importantly, influenza vaccine may not be available in the northern hemisphere during this period; thus advance planning is warranted.

Brazil is considered to have intermediate hepatitis B prevalence overall<sup>5</sup> although the capital cities reported low prevalence.<sup>16</sup> All travelers should be counseled of the risks of blood/body fluid contact, which could result in exposure to serious infections such as hepatitis B, HIV, and other blood-borne and sexually transmitted infections.

The database lacked specific locations to be visited in Brazil, thus limiting precise YF or malaria risk determination. These data may not be representative of all travelers to Brazil because only a minority of travelers seek pre-travel advice.<sup>17</sup> BATMN may also have a larger proportion of travelers to Brazil than travel clinics elsewhere, although BATMN travelers' characteristics appear similar to other US travelers seeking advice.<sup>17</sup> Also, although we did not assess measles, mumps, rubella, or meningococcal vaccinations in this analysis, the risk of infection in mass gatherings should be borne in mind, exemplified by meningococcal disease associated with the Hajj pilgrimage. Finally, lack of details on past immunizations limited conclusions about appropriateness of vaccine administration.

## Conclusions

Detailed itinerary review is required when counseling travelers to Brazil to determine need for malaria prophylaxis and YF vaccination, including event locations for travelers to the World Cup and Olympics. Dengue transmission occurs year-round and a significant proportion of BATMN travelers visited during peak dengue activity. Counseling regarding protection against mosquitoes is essential in preventing dengue as well as other mosquito-borne diseases. Hepatitis A vaccine should be recommended. Most travelers visit Brazil during the peak influenza season in southern Brazil and influenza vaccination should be encouraged, especially for travel involving crowds such as at the World Cup and Olympics.

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**Table 1**Demographics and key interventions of travelers to Brazil (*N* = 599)

	Brazil travelers <i>n</i> (%)
Male	284 (47)
Mean age in years (IQR)	33 (23–52)
Country of origin Brazil	45 (8)
Mean duration in days (IQR)	15 (10–28)
Trip duration	
<2weeks	268 (45)
2–4weeks	189 (32)
1–4 months	89 (15)
4+ months	36 (6)
Comorbidities	
Immunocompromised	19 (3)
Pregnant	1 (0.2)
Medical comorbidity	74 (12)
Accommodation	
Hotel or hostel	354 (59)
Home/local residence	186 (31)
Tent	22 (4)
Purpose for travel	
Tourism	307 (51)
Visiting friends and relatives	127 (21)
Business	86 (14)
Education/research	38 (6)
Missionary/volunteer	17 (3)
<b>Key interventions*</b>	
Travelers' diarrhea—total prescriptions	509/596 (85)
Ciprofloxacin	408/596 (69)
Azithromycin	87/596 (15)
Levofloxacin	13/499 (3)
Rifaximin	1/437 (0.2)
Malaria—total chemoprophylaxis	232/595 (39)
Atovaquone/proguanil	189/595 (32)
Mefloquine	22/595 (4)
Chloroquine	15/595 (3) †
Doxycycline	6/595 (1)
Primaquine	0/437
Vaccinations	
Influenza at travel clinic visit	84/582 (14)
Past vaccination ‡	172/298 (58) ‡
Hepatitis A at travel clinic visit	293/583 (50)

	<b>Brazil travelers <i>n</i> (%)</b>
Past vaccination	125/320 (39)
Hepatitis B at travel clinic visit	62/582 (11)
Past vaccination	158/332 (48)
Rabies at travel clinic visit	16/582 (3)
Past vaccination	14/266 (5)
Typhoid at travel clinic visit	337/583 (58)
Past vaccination	157/379 (41)
Yellow fever at travel clinic visit	415/583 (71)
Past vaccination	157/366 (43)

\* Not all respondents answered each question regarding key interventions, therefore denominators are shown for clarification.

<sup>†</sup> The Brazil travelers given chloroquine were also traveling to other Latin American countries where chloroquine was appropriate chemoprophylaxis.

<sup>‡</sup> May include past season vaccine, thus may not be specific for the current season.