Am. J. Trop. Med. Hyg., 90(3), 2014, pp. 553–559
doi:10.4269/ajtmh.13-0479

Pre-Travel Preparation of US Travelers Going Abroad to Provide Humanitarian Service, Global TravEpiNet 2009–2011

Rhett J. Stoney,* Emily S. Jentes, Mark J. Sotir, Phyllis Kozarsky, Sowmya R. Rao, Regina C. LaRocque, Edward T. Ryan, and the Global TravEpiNet Consortium

Travelers' Health Branch, Division of Global Migration and Quarantine, Centers for Disease Control and Prevention, Atlanta, Georgia; Department of Quantitative Health Sciences, University of Massachusetts Medical School, Worcester, Massachusetts; Center for Healthcare Organization and Implementation Research (CHOIR), Bedford Veteran Affairs Medical Center, Bedford, Massachusetts; Division of Infectious Diseases, Massachusetts General Hospital, Boston, Massachusetts; Department of Medicine, Harvard Medical School, Boston, Massachusetts

Abstract. We analyzed characteristics of humanitarian service workers (HSWs) seen pre-travel at Global TravEpiNet (GTEN) practices during 2009–2011. Of 23,264 travelers, 3,663 (16%) travelers were classified as HSWs. Among HSWs, 1,269 (35%) travelers were medical workers, 1,298 (35%) travelers were non-medical service workers, and 990 (27%) travelers were missionaries. Median age was 29 years, and 63% of travelers were female. Almost one-half (49%) traveled to 1 of 10 countries; the most frequent destinations were Haiti (14%), Honduras (8%), and Kenya (6%). Over 90% of travelers were vaccinated for or considered immune to hepatitis A, typhoid, and yellow fever. However, for hepatitis B, 292 (29%) of 990 missionaries, 228 (18%) of 1,298 non-medical service workers, and 76 (6%) of 1,269 medical workers were not vaccinated or considered immune. Of HSWs traveling to Haiti during 2010, 5% of travelers did not receive malaria chemoprophylaxis. Coordinated efforts from HSWs, HSW agencies, and clinicians could reduce vaccine coverage gaps and improve use of malaria chemoprophylaxis.

INTRODUCTION

Global humanitarian staffing levels for internationally operating aid organizations have increased at a rate of 6% annually, and in 2008, they reached a total population of roughly 595,000 humanitarian service workers (HSWs) worldwide.[1] HSWs can include missionaries, medical service workers, or individuals traveling overseas to perform short- or long-term humanitarian work. Because of the nature of their work,[2,3] length of stay,[4] and travel destinations, which are primarily low-resource countries, HSWs face different risks of illness and injury than persons traveling for other purposes.[3,5,6] There have been numerous reports of HSWs returning home ill, including those HSWs who were responding to complex overseas emergencies.[7–10] A recent study found that, among 185 ill travelers returning home from Haiti in 2010, 142 (77%) travelers were providing humanitarian assistance after the January of 2010 earthquake.[8]

An accurate percentage of HSWs seeking pre-travel preparations is not known, and previous studies of ill HSW travelers vary greatly in their estimates (15–71%).[7,8,11] Furthermore, travelers who do access health resources before departure may not always receive the most up-to-date recommendations.[12] Although pre-travel healthcare cannot guarantee a traveler's health and safety, a well-organized and -executed consultation can use counseling, education, and administration of vaccines and prescriptions to help reduce and manage the risk of illness and injury during travel.[13]

We sought to describe characteristics of HSWs traveling abroad from the United States to identify opportunities to target preventive interventions for these unique populations.

METHODS

Study population. The Global TravEpi Network (GTEN) Consortium is a national network of US practices that provide pre-travel health consultations to international travelers.[14] Data from consultations were collected from travelers seen at 1 of 18 GTEN practices from January of 2009 through December of 2011. An institutional review board at each participating site reviewed and approved the study.

For each consultation, travelers self-reported their medical history, itinerary, and travel purpose details. Clinicians verified this information with the traveler and entered additional data on vaccination history, health advice provided, vaccines administered, and medications prescribed into the GTEN online tool. No serologic tests were conducted to confirm immunity. If a vaccine was indicated according to current recommendations of the US Centers for Disease Control and Prevention (CDC) but not administered at the pre-travel visit, the clinician was prompted to provide a reason for not administering the vaccine, such as the traveler's pre-existing immunity, the clinician's belief that the vaccine was not indicated, referral of the patient to another provider for vaccination, the traveler declined the vaccine, the clinician's assessment that a medical contraindication to vaccination existed, lack of sufficient time for vaccination, or lack of availability of the vaccine. For rabies vaccine, clinicians were prompted to provide a reason if the vaccine was not recommended for those HSWs traveling ≥ 1 month (28 days).

Definitions and variables. Travelers reporting missionary work, medical care, or non-medical service work as their purpose of travel were considered HSWs in this analysis. For comparative analyses, HSWs were grouped into one of three categories (missionary, medical, or non-medical). Medical workers included all HSWs who indicated performing medical service or any combination of medical work and other humanitarian service. Those HSWs who indicated that they were performing both missionary and non-medical work were included in the overall analysis but excluded from comparative analyses between different categories of HSWs. Children under 18 years of age and those indicating a purpose of travel other than missionary, medical, or non-medical were excluded from the analyses.

We evaluated the proportion of GTEN travelers vaccinated for the following diseases: hepatitis A, hepatitis B,

*Address correspondence to Rhett J. Stoney, Division of Global Migration and Quarantine, Centers for Disease Control and Prevention, 1600 Clifton Road, MS E-03, Atlanta, GA 30333. E-mail: uyn2@cdc.gov

measles-mumps-rubella (MMR), tetanus-diphtheria-pertussis (Td/Tdap), varicella, typhoid, rabies, polio, meningococcal disease, Japanese encephalitis (JE), and yellow fever (YF). For this analysis, hepatitis B, Td/Tdap, MMR, and varicella vaccines were defined as generally recommended for all HSWs before departure if they were not already immune. The proportion of travelers vaccinated for hepatitis A, typhoid, rabies, polio, meningococcal disease, JE, and YF was assessed for specific groups of at-risk HSWs who met criteria (e.g., destination country with risk or season with risk) for recommended vaccination based on the most current CDC recommendations available at the time of the consultation.[13,15,16] Specifically, rabies vaccination status was assessed for queried travelers who went to countries considered at the highest risk for rabies exposure. A more extensive description of this rabies exposure risk methodology is provided elsewhere.[17]

Vaccination status for YF and JE was assessed only for those HSWs traveling to areas of known risk according to the most current CDC recommendations available at the time of pre-travel consultation.[18,19] Travelers going to destinations with risk for YF virus transmission were defined as those travelers visiting countries considered entirely endemic (where YF vaccine should always be recommended unless there is a contraindication) or partially endemic and for which the provider noted that YF vaccine was indicated by the traveler's stated itinerary. Travelers going to partially endemic countries and for whom the provider chose "vaccination not indicated for this itinerary" were excluded from YF vaccine analyses. JE vaccine was considered to be indicated for travelers going to an endemic country for 30 or more days during the peak season of JE transmission and who traveled outside of an urban area, or if they traveled fewer than 30 days and visited rural areas exclusively.

Meningococcal vaccine was considered to be indicated for travelers to countries in the meningitis belt of Africa during the dry season (December to June).[15] Travelers were considered vaccinated/immune if they reported pre-existing immunity from vaccination within the previous 5 years or received quadrivalent meningococcal vaccine at the GTEN visit. A polio booster was considered to be indicated for travelers to polio-endemic or -epidemic areas, including countries with recent proven wild-type polio virus circulation and neighboring countries, according to the most current travel notices published by the CDC at the time of the pre-travel consultation. For all vaccines, if the clinician indicated existing immunity or if the traveler received at least the first dose of a vaccine series at the pre-travel consultation, the traveler was considered vaccinated for that specific disease. Malaria chemoprophylaxis was also assessed for HSWs traveling to countries holoendemic for malaria according to *CDC Health Information for International Travel*.[13,15]

Data analysis. We obtained frequency distributions for demographics, travel destinations, vaccinations, and type of malaria chemoprophylaxis prescribed. A Kruskal–Wallis test was performed to assess the relationship of age and HSW group overall. In addition, it was used in a subanalysis of those HSWs traveling to Haiti during 2010 to compare differences between the HSW group and trip duration. Statistical significance was determined at the two-sided 0.05 level. SAS 9.2 (SAS Institute, Cary, NC) was used for all analyses.

RESULTS

Demographic and trip characteristics. Of 23,264 GTEN travelers seen at clinics during the study period, 3,663 (16%) travelers were classified as HSWs. Among these 3,663 HSWs, 1,269 (35%) HSWs were medical workers, 1,298 (35%) HSWs were non-medical service workers, and 990 (27%) HSWs were missionaries (Table 1). The remaining 3% of travelers indicated performing a combination of missionary and non-medical work.

TABLE 1
Demographic characteristics of HSWs by type of service performed (GTEN from January of 2009 through December of 2011)

Characteristic	Total* (*N* = 3,663)	Missionary only (*N* = 990)	Non-medical only (*N* = 1,298)	Medical† (*N* = 1,269)
Age (years)				
Median (interquartile range)‡	29 (22–45)	39 (24–53)	24 (20–36)	29 (25–38)
18–25 *n* (col. %)§	1,414 (39)	276 (28)	736 (57)	372 (30)
26–45 *n* (col. %)	1,356 (37)	317 (32)	334 (26)	662 (52)
46–64 *n* (col. %)	666 (18)	324 (33)	196 (15)	207 (16)
> 65 *n* (col. %)	230 (6)	73 (7)	32 (2)	28 (2)
Sex *n* (col. %)				
Female	2,295 (63)	564 (57)	845 (65)	826 (65)
Male	1,368 (37)	426 (43)	453 (35)	443 (35)
Time to departure (days)				
Median (range)	28 (0–405)	32 (0–396)	29 (0–405)	25 (0–366)
Duration of travel¶ (days)				
Median (interquartile range)	13 (8–21)	12 (8–21)	13 (8–21)	13 (8–23)
Number of destination countries *n* (col. %)				
1	3,020 (82)	838 (85)	1,040 (80)	1,060 (83)
2	387 (11)	98 (10)	132 (10)	140 (11)
3	123 (3)	34 (3)	53 (4)	33 (3)
≥ 4	133 (4)	20 (2)	73 (6)	36 (3)
Geographic type of destination *n* (col. %)				
Rural only	715 (19)	165 (17)	310 (24)	222 (17)
Urban only	728 (20)	219 (22)	199 (15)	288 (23)
Rural and urban	2,220 (61)	606 (61)	789 (61)	759 (60)

*Includes HSWs who indicated both missionary and non-medical service work.
†Category includes all HSWs who indicated performing medical service as well as HSWs performing any combination of medical work and other humanitarian service.
‡Non-medical service workers were significantly younger ($P < 0.0001$) than missionaries. Medical service workers were significantly younger ($P < 0.0001$) than missionaries. Non-medical workers were significantly younger than medical workers ($P < 0.0001$).
§Col. % = column percent.
¶Only HSWs who traveled to one country from January of 2009 through December of 2011 were included for duration of travel.

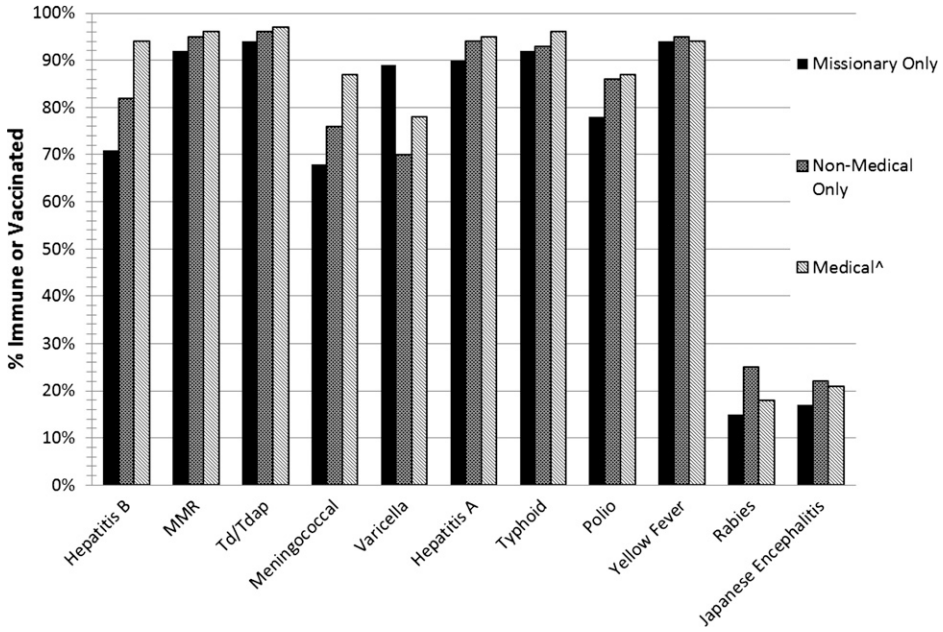

FIGURE 1. Proportion of HSWs vaccinated or already immune at time of pre-travel consultation for vaccine-preventable diseases by type of service performed (GTEN from January of 2009 through December of 2011). ^Category includes all HSWs who indicated performing medical service as well as HSWs performing any combination of medical work and other humanitarian service.

Missionaries were significantly older (median = 39 years) than non-medical service workers (median = 24 years, $P < 0.001$) and medical workers (median = 29 years, $P < 0.001$). Most HSWs (63%) were female. HSWs attended a pre-travel health visit a median of 4 weeks in advance of departure; most HSWs (82%) traveled to one country. The top five destinations for all HSWs were Haiti (14%), Honduras (8%), Kenya (6%), Uganda (6%), and Ghana (5%). The median trip duration for HSWs traveling abroad was 13 days.

Vaccinations. Coverage varied by vaccine and type of humanitarian service performed (Figure 1). More than 90% of missionaries, non-medical workers, and medical service workers were vaccinated for or considered immune to MMR, Td/Tdap, hepatitis A, typhoid, and YF; 292 (29%) of 990 missionaries, 228 (18%) of 1,298 non-medical service workers, and 76 (6%) of 1,269 medical workers were not vaccinated or considered immune for hepatitis B at the pre-travel consultation. Of these 596 HSWs, 166 (57%) of 292 missionaries, 132 (58%) of 228 non-medical service workers, and 48 (63%) of 76 medical workers did not receive vaccination because the clinician reported the vaccine not indicated for the travelers' itineraries. Other reasons for non-vaccination of hepatitis B among these 596 HSWs included 124 (21%) HSWs who declined, 84 (14%) HSWs who were referred to another healthcare provider, and 40 (7%) HSWs who reported insufficient time to complete the vaccination series.

Among 563 HSWs indicated for meningococcal vaccine, 37 (32%) of 116 missionaries, 47 (24%) of 194 non-medical service workers, and 31 (13%) of 233 medical workers were not vaccinated or considered immune at the pre-travel consultation. The most commonly reported reason (42%) for non-vaccination of meningococcal disease among these 115 HSWs was that it was not considered indicated for their itinerary. Of 31 medical workers not vaccinated for meningococcal disease, 15 (48%) HSWs declined the vaccine, and 14 (45%) HSWs did not receive it because the clinician believed that it was not indicated for their specific itinerary.

When a polio booster was indicated, 80 (22%) of 357 missionaries, 74 (14%) of 526 non-medical service workers, and 63 (13%) of 501 medical service workers were not vaccinated for or considered immune to polio at the pre-travel consultation. Reasons for non-vaccination were available for 84 of these HSWs; the most common reasons were traveler declining (58%) and clinician indicating that the vaccine was not necessary for the itinerary (35%).

Less than 25% of HSWs with an indication for vaccination with either JE or rabies vaccine were vaccinated or considered immune at the time of the pre-travel consultation. For JE, 40 (44%) of 90 unvaccinated HSWs did not receive vaccine because the clinician considered it to be unnecessary for the itinerary; 37 (41%) HSWs declined JE vaccination. For rabies, 588 (74%) of 800 unvaccinated HSWs did not receive the vaccine because the clinician considered it to be unnecessary for the itinerary; 145 (18%) of 800 HSWs declined rabies vaccination.

Malaria chemoprophylaxis. Malaria chemoprophylaxes prescribed among those HSWs traveling to the 10 most frequented countries for HSWs are listed in Table 2. In total, 58 (7%) of 780 travelers going to Ghana, Haiti, or Uganda did not receive malaria chemoprophylaxis at the time of the GTEN pre-travel consultation, despite the ubiquity of malaria in these countries. The median duration of stay for HSWs traveling to these three countries was 10 days.

Haiti 2010 post-earthquake response. In total, 275 HSWs traveled to Haiti during 2010 after the severe earthquake on January 12, 2010. The median age of these HSWs was 39 years; 56% of travelers were female. Among these HSWs, 59 (21%) HSWs were missionaries, 75 (27%) HSWs were non-medical service workers, and 129 (47%) HSWs were medical workers. The median duration of stay for medical

TABLE 2
Prescriptions of antimalarial medications for HSWs visiting the top 10* travel destinations (GTEN from January of 2009 through December of 2011)

	Country** (*n*, column %)									
	Haiti† (*N* = 460)	Honduras (*N* = 294)	Kenya (*N* = 187)	Uganda† (*N* = 137)	Ghana† (*N* = 183)	India (*N* = 150)	Tanzania (*N* = 86)	Peru (*N* = 106)	Guatemala (*N* = 107)	Panama (*N* = 81)
Antimalarial prescribed										
Atovaquone/proguanil only	123 (27)	20 (7)	111 (59)	103 (75)	142 (78)	99 (66)	61 (71)	44 (42)	8 (7)	29 (36)
Chloroquine phosphate only	276 (60)	240 (82)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	59 (55)	41 (51)
Mefloquine only	3 (1)	1 (0.3)	20 (11)	13 (10)	9 (5)	5 (3)	4 (5)	1 (1)	0 (0)	0 (0)
Doxycycline only	9 (2)	1 (0.3)	27 (14)	16 (12)	16 (9)	26 (17)	10 (12)	5 (5)	3 (3)	4 (5)
Total‡	419 (91)	263 (89)	161 (86)	133 (97)	170 (93)	131 (87)	76 (88)	50 (47)	70 (65)	74 (91)
Antimalarial not prescribed this visit										
Referred to/received from PCP#	14 (3)	7 (2)	6 (3)	2 (1)	8 (4)	2 (1)	1 (1)	3 (3)	2 (2)	0 (0)
No information listed for traveler§	26 (6)	22 (7)	20 (11)	2 (1)	5 (3)	17 (11)	8 (9)	47 (44)	25 (23)	7 (9)
Total¶	41 (9)	31 (11)	26 (14)	4 (3)	13 (7)	19 (13)	10 (12)	56 (53)	37 (35)	7 (9)

*Includes the top 10 most frequently visited countries from January of 2009 through December of 2011. Only HSWs that traveled to one country from January of 2009 through December of 2011 are included.
**Countries might include both areas with and without risk for malaria unless otherwise noted. Therefore, dependent on the traveler's itinerary, prophylaxis might not have been recommended according to the most up-to-date CDC health information.[13,15]
†Country is considered holoendemic for malaria according to the most up-to-date CDC health information.[13,15]
‡Included but not listed are two travelers who were not prescribed specific antimalarial medications, but it was recorded that they received self-treatment or terminal prophylaxis. Also, 16 travelers who were prescribed more than one antimalarial at the time of the GTEN pre-travel consultation are included.
#PCP = primary care provider.
§For the time period of this report, reasons for failure to prescribe antimalarial prophylaxis were not systematically collected.
¶Others not listed here include 17 HSWs for whom the clinician stated that malaria chemoprophylaxis was not necessary (Guatemala [10], Peru [6], and Honduras [1]) and 3 HSWs who declined (Haiti [1], Honduras [1], and Tanzania [1]).

workers was 14 days compared with 7 days for both missionaries and non-medical service workers ($P < 0.0001$). Two hundred sixty-two (95%) of 275 HSWs received malaria chemoprophylaxis for their trip, with chloroquine phosphate being the most commonly prescribed (65%) followed by atovaquone/proguanil (29%), doxycycline (3%), and mefloquine (2%). One HSW received self-treatment or terminal prophylaxis.

DISCUSSION

This report summarizes pre-travel care received by HSWs at GTEN clinics from 2009 through 2011. HSWs were predominately female (63%), and missionaries were significantly older than other HSWs. The most common destination was Haiti, likely attributable to relief efforts after the 2010 earthquake near Port au Prince.[8] Overall, HSWs attended the pre-travel consultation a median of 4 weeks in advance of their trip, and most HSWs were vaccinated for MMR, Td/Tdap, hepatitis A, typhoid, and YF. However, vaccination gaps existed for other diseases. The proportion of HSWs vaccinated for hepatitis B was particularly low among missionaries, whereas gaps in both hepatitis B and meningococcal vaccines existed among medical workers. Furthermore, some HSWs were not vaccinated for polio or JE, even though these vaccines were indicated based on recommendations available at the time of the pre-travel consultation.

We found that vaccination against hepatitis B was lower than for other generally recommended vaccines. Specifically, 6% of medical workers were not vaccinated for or considered immune to hepatitis B, despite Advisory Committee on Immunization Practices (ACIP) recommendations that hepatitis B vaccine is indicated for all healthcare workers, regardless of place of practice. This vaccination is particularly important for medical personnel working abroad in less than optimal conditions. One explanation for the gap for medical workers could be that few states mandate hepatitis B vaccination for healthcare workers, although some states mandate that the vaccine be available.[20] Missionaries had the lowest hepatitis B vaccination rate among the three categories of HSWs. Although hepatitis B risk has been shown to be higher in missionaries serving overseas, there are no consensus recommendations for missionary health.[9,21] However, ACIP recommends hepatitis B vaccination for all international travelers going to regions with high or intermediate levels of endemic hepatitis B infection.[20] These areas include popular missionary destinations, such as sub-Saharan Africa, Asia, and Latin America.[9] Despite these recommendations, a study surveying 61 missionary boards found that only 31% recommended hepatitis B vaccination for their staff before international travel.[9] Although cost might be a factor, we were unable to assess it in this analysis. Because many HSWs travel repetitively, a hepatitis B vaccination series would provide long-term protection for current and future trips.[22,23]

We also found a gap in meningococcal vaccination among HSWs, despite travel to at-risk countries during peak season. Because of their age, some HSWs may not have received the current meningococcal vaccine licensed for use in 2005 as children. In addition, routine and booster vaccination of healthy persons not at increased risk for exposure to *Neisseria meningitidis* is not recommended after age 21 years.[20] Unvaccinated HSWs traveling for longer durations and engaging in activities with the local population in confined areas (e.g., refugee camps) may be at greater risk for meningococcal disease.[24] Although meningococcal disease incidence in most international travelers is lower than other diseases, it has high morbidity and mortality and should be considered in the individual pre-travel consultation.[24]

In total, 15% of HSWs were not vaccinated for or considered immune to polio, despite travel to a destination where the vaccine was recommended. Clinicians reported that polio vaccine was not indicated for the travel itinerary in 35% of those HSWs not vaccinated. Despite eradication efforts, polio continues to be a global threat, even in non-endemic countries, because of international travel.[25] From 2008 to 2010, wild-type polio outbreaks from importations occurred in 28 countries in Africa, Eastern Europe, North Asia, and South Asia.[26] Clinicians should stay current on recommendations for polio vaccine by visiting the CDC Travelers' Health website (www.cdc.gov/travel).[16]

In our analysis, the proportion of HSWs vaccinated for or considered immune to rabies and JE was higher than in other studies.[27–29] However, less than one-quarter of HSWs for whom rabies and JE vaccinations were indicated had previous vaccination or received vaccination at the pre-travel consultation.[27,28,30] In addition, 14% of HSWs for whom the rabies vaccine was indicated and 32% of HSWs for whom the JE vaccine was indicated declined vaccination. Although identifying the exact reasons for declining the vaccine was beyond the scope of this report, previous studies have found several reasons for travelers' refusal of rabies and JE vaccination, including high cost, low perception of benefit, and concern for an adverse reaction.[17,28–30] Strategic interventions should be considered to increase the uptake of rabies and JE vaccines pre-travel in these at-risk populations.[31]

During 2010, more GTEN HSWs traveled to Haiti than any other country. Specifically, more medical workers traveled to Haiti in the first quarter of 2010, likely responding to the January of 2010 earthquake. Although most HSWs received malaria chemoprophylaxis during their pre-travel consultation, a few did not. Malaria prevention, including providing proper chemoprophylaxis and mosquito protection education, is essential for travelers to Haiti and similar destinations. In a recent report, cases of malaria among aid workers occurred in persons who had not taken malaria chemoprophylaxis, and no cases were identified among 52 aid workers who took 346 person-weeks of chloroquine prophylaxis.[32] Another study found that dengue fever and malaria contributed to over 60% of severe disease requiring hospitalization after return from Haiti.[8]

We found that GTEN HSWs traveled a median of 13 days. Although longer duration of stay can increase the exposure risk to a number of infections for travelers, HSWs can also be at risk during short trips. For example, in a 2008 humanitarian mission to the Dominican Republic, 14 of 33 missionaries acquired dengue fever after being in the country for fewer than 10 days.[7] In another study, 7 of 28 travelers acquired an acute dengue infection in Haiti after being in the country for approximately 1 week.[10]

Our analysis has several limitations. First, GTEN may not be representative of the healthcare provided to individuals traveling internationally from the United States. GTEN practices are designated YF vaccination centers and therefore, have some specialized experience in travel medicine. As such, the proportion of travelers vaccinated or given medications at GTEN clinics may be different than the proportion in clinics with no specialization in travel medicine. Second, this analysis does not include international travelers who do not seek healthcare before going abroad.[12] Third, we relied on self-reported data from travelers, and consistent with general clinical practice, serologic confirmation of immunization history was infrequent. Fourth, although the GTEN reporting tool is standardized, there may have been variability in clinician usage and response. Specifically, because the GTEN reporting tool is standardized, we were unable to evaluate each clinical encounter, and we understand that there may be nuances in individual cases that determine the suitability of recommending for or against certain vaccines. Fifth, we do not know whether HSWs received additional consultation, vaccinations, or prescriptions outside of the GTEN pre-travel consultation. For rabies vaccination, clinicians were prompted to enter reasons for non-vaccination only when the traveler was leaving for longer than 28 days; therefore, the tool did not prompt vaccination for shorter-term travelers who could still have a high risk of exposure based on elements of their itinerary other than duration of stay. Sixth, because subnational data were not available, we could only assess the suitability of malaria chemoprophylaxis recommendations in those HSWs traveling to countries holoendemic for malaria. Lastly, those HSWs who indicated that they were providing medical service may not be representative of all healthcare workers.

HSWs and the agencies that support their missions should consider pre-travel healthcare as an integral part of their travel preparation. To limit the risk of illness and injury, HSWs must coordinate with the agencies that support their missions, primary care providers, and travel medicine specialists. HSWs need to take an active role in preparing for healthy travel by gathering information about their travel destinations and possible activities, especially when traveling to emergency relief areas and engaging with local populations, no matter the duration of travel. Agencies supporting the missions of HSWs must understand the value of the pre-travel health consultation and encourage their HSWs to seek pre-travel care. In addition, primary care providers need to take an active role in understanding travel medicine, because an increasing number of international travelers seek pre-travel advice from primary care providers compared with other health information sources.[33,34] Clinicians can use the itinerary details outlined by HSWs and their agencies to tailor specific recommendations, immunizations, and medications that are appropriate for the mission. Clinicians should stay up to date on current travel medicine recommendations and work to reduce gaps in vaccination among travelers, especially those who may have future travel to areas at risk. As such, clinicians can use the pre-travel health consultation as an opportunity to administer routine vaccines, such as hepatitis B, to travelers who may not have received the vaccine in the past. Taking these steps may reduce the risk of illness in HSW travelers.

Received August 20, 2013. Accepted for publication December 23, 2013.

Published online January 20, 2014.

Acknowledgments: Members of the Global TravEpiNet Consortium (in alphabetical order) include George M. Abraham, Saint Vincent Hospital (Worcester, MA); Salvador Alvarez, Mayo Clinic (Jacksonville, FL); Vernon Ansdell and Johnnie A. Yates, Travel Medicine Clinic, Kaiser Permanente (Honolulu, HI); Elisha H. Atkins, Chelsea HealthCare Center (Chelsea, MA); John Cahill, Travel and Immunization Center, St. Luke's-Roosevelt (New York, NY); Holly K. Birich and Dagmar Vitek, Salt Lake Valley Health Department (Salt Lake, UT); Bradley A. Connor, New York Center for Travel and Tropical Medicine, Cornell University (New York, NY); Roberta Dismukes and Phyllis Kozarsky, Emory TravelWell, Emory University (Atlanta, GA); Ronke Dosunmu, JourneyHealth (Maywood, NJ); Jeffrey A. Goad, International Travel Medicine Clinic, University of Southern California (Los Angeles, CA); Stefan Hagmann, Division of Pediatric Infectious Diseases, Bronx Lebanon Hospital Center (Bronx, NY); DeVon Hale, International Travel Clinic, University of Utah (Salt Lake City, UT); Noreen A. Hynes, John Hopkins Travel and Tropical Medicine, Division of Infectious Diseases, John Hopkins School of Medicine (Baltimore, MD); Frederique Jacquerioz and Susan McLellan, Tulane University (New Orleans, LA); Mark Knouse, Keystone Travel Medicine, Lehigh Valley Health Network (Allentown, PA); Jennifer Lee, Travel and Immunization Center, Northwestern Memorial Hospital (Chicago, IL); Regina C. LaRocque and Edward T. Ryan, Massachusetts General Hospital (Boston, MA); Alawode Oladele and Hanna Demeke, DeKalb County Board of

Health Travel Services–DeKalb North and Central–T.O. Vinson Centers (Decatur, GA); Roger Pasinski and Amy E. Wheeler, Revere HealthCare Center (Revere, MA); Sowmya R. Rao, University of Massachusetts (Worcester, MA); Jessica Rosen, Infectious Diseases and Travel Medicine, Georgetown University (Washington, DC); Brian S. Schwartz, Travel Medicine and Immunization Clinic, University of California (San Francisco, CA); William Stauffer and Patricia Walker, HealthPartners Travel Medicine Clinics (St. Paul, MN); Lori Tishler, Phyllis Jen Center for Primary Care, Brigham and Women's Hospital (Boston, MA): and Joseph Vinetz, Travel Clinic, Division of Infectious Diseases, Department of Medicine, University of California at San Diego School of Medicine (La Jolla, CA).

Financial support: This work was supported by US Centers for Disease Control and Prevention Grants U19CI000514 and U01CK000175. This research was supported, in part, by an appointment to the Research Participation Program at the Centers for Disease Control and Prevention administered by the Oak Ridge Institute for Science and Education through an interagency agreement between the US Department of Energy and the Centers for Disease Control and Prevention.

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

Authors' addresses: Rhett J. Stoney, Emily S. Jentes, Mark J. Sotir, and Phyllis Kozarsky, Division of Global Migration and Quarantine, Centers for Disease Control and Prevention, Atlanta, GA, E-mails: uyn2@cdc.gov, ejentes@cdc.gov, pbk7@cdc.gov, and mps6@cdc.gov. Sowmya R. Rao, Department of Quantitative Health Sciences, University of Massachusetts Medical School, Worcester, MA, and Center for Health Quality, Outcomes, and Economic Research, Bedford Veterans Administration Medical Center, Bedford, MA, E-mail: sowmya.rao@umassmed.edu. Regina C. LaRocque and Edward T. Ryan, Division of Infectious Diseases, Massachusetts General Hospital, Boston, MA, E-mails: rclarcque@partners.org and etryan@partners.org.

REFERENCES

1. Active Learning Network for Accountability and Performance in Humanitarian Action, 2010. *The State of the Humanitarian System: Assessing Performance and Progress: A Pilot Study*. Available at: www.alnap.org. Accessed December 10, 2011.
2. Dahlgren AL, Deroo L, Avril J, Bise G, Loutan L, 2009. Health risks and risk-taking behaviors among International Committee of the Red Cross (ICRC) expatriates returning from humanitarian missions. *J Travel Med 16:* 382–390.
3. Goesch JN, Simons de Fanti A, Bechet S, Consigny PH, 2010. Comparison of knowledge on travel related health risks and their prevention among humanitarian aid workers and other travellers consulting at the Institut Pasteur travel clinic in Paris, France. *Travel Med Infect Dis 8:* 364–372.
4. Chen LH, Wilson ME, Davis X, Loutan L, Schwartz E, Keystone J, Hale D, Lim PL, McCarthy A, Gkrania-Klotsas E, Schlagenhauf P; GeoSentinel Surveillance Network, 2009. Illness in long-term travelers visiting GeoSentinel clinics. *Emerg Infect Dis 15:* 1773–1782.
5. Callahan MV, Hamer DH, 2005. On the medical edge: preparation of expatriates, refugee and disaster relief workers, and Peace Corps volunteers. *Infect Dis Clin North Am 19:* 85–101.
6. Kortepeter MG, Seaworth BJ, Tasker SA, Burgess TH, Coldren RL, Aronson NE, 2010. Health care workers and researchers traveling to developing-world clinical settings: disease transmission risk and mitigation. *Clin Infect Dis 51:* 1298–1305.
7. Centers for Disease Control and Prevention, 2010. Dengue fever among U.S. travelers returning from the Dominican Republic—Minnesota and Iowa, 2008. *MMWR Morb Mortal Wkly Rep 59:* 654–656.
8. Esposito DH, Han PV, Kozarsky PE, Walker PF, Gkrania-Klotsas E, Barnett ED, Libman M, McCarthy AE, Field V, Connor BA, Schwartz E, MacDonald S, Sotir MJ; GeoSentinel Surveillance Network, 2012. Characteristics and spectrum of disease among ill returned travelers from pre- and post-earthquake Haiti: the GeoSentinel experience. *Am J Trop Med Hyg 86:* 23–28.
9. Lange WR, Kreider SD, Kaczaniuk MA, Snyder FR, 1987. Missionary health: the great omission. *Am J Prev Med 3:* 332–338.
10. Sharp TM, Pillai P, Hunsperger E, Santiago GA, Anderson T, Vap T, Collinson J, Buss BF, Safranek TJ, Sotir MJ, Jentes ES, Munoz-Jordan JL, Arguello DF, 2012. A cluster of dengue cases in American missionaries returning from Haiti, 2010. *Am J Trop Med Hyg 86:* 16–22.
11. Flores-Figueroa J, Okhuysen PC, von Sonnenburg F, DuPont HL, Libman MD, Keystone JS, Hale DC, Burchard G, Han PV, Wilder-Smith A, Freedman DO; GeoSentinel Surveillance Network, 2011. Patterns of illness in travelers visiting Mexico and Central America: the GeoSentinel experience. *Clin Infect Dis 53:* 523–531.
12. LaRocque RC, Rao SR, Tsibris A, Lawton T, Barry MA, Marano N, Brunette G, Yanni E, Ryan ET, 2010. Pre-travel health advice-seeking behavior among US international travelers departing from Boston Logan International Airport. *J Travel Med 17:* 387–391.
13. Centers for Disease Control and Prevention, 2010. *CDC Health Information for International Travel 2010*. Atlanta, GA: US Department of Health and Human Services, Public Health Service.
14. Larocque RC, Rao SR, Lee J, Ansdell V, Yates JA, Schwartz BS, Knouse M, Cahill J, Hagmann S, Vinetz J, Connor BA, Goad JA, Oladele A, Alvarez S, Stauffer W, Walker P, Kozarsky P, Franco-Paredes C, Dismukes R, Rosen J, Hynes NA, Jacquerioz F, McLellan S, Hale D, Sofarelli T, Schoenfeld D, Marano N, Brunette G, Jentes ES, Yanni E, Sotir MJ, Ryan ET; the Global TravEpiNet C, 2012. Global TravEpiNet: a national consortium of clinics providing care to international travelers—analysis of demographic characteristics, travel destinations, and pretravel healthcare of high-risk US international travelers, 2009–2011. *Clin Infect Dis 54:* 455–462.
15. Centers for Disease Control and Prevention, 2012. *CDC Health Information for International Travel*. Atlanta, GA: US Department of Health and Human Services, Public Health Service.
16. Centers for Disease Control and Prevention, 2013. *CDC Travelers' Health*. Available at: http://wwwnc.cdc.gov/travel/. Accessed March 5, 2013.
17. Dolan SB, Jentes ES, Sotir MJ, Han P, Blanton JD, Rao SR, LaRocque RC, Ryan ET, and the Global Travepinet Consortium, 2013. Pre-exposure rabies vaccination among US international travelers: findings from the global TravEpiNet Consortium. *Vector Borne Zoonotic Dis* [epub ahead of print December 20, 2013].
18. Gershman M, Schroeder B, Jentes ES, Marano N, 2009. Yellow fever vaccine requirements and recommendations, by country. Brunette G, ed. *CDC Health Information for International Travel 2010*. Atlanta, GA: US Department of Health and Human Services, Public Health Service.
19. Gershman M, Jentes ES, Sommers T, Staples J, Tan KR, Arguin PM, Steele SF, 2012. Yellow fever and malaria information, by country. Brunette G, ed. *CDC Health Information for International Travel 2012*. Atlanta, GA: US Department of Health and Human Services, Public Health Service.
20. Centers for Disease Control and Prevention, 2011. *Advisory Committee on Immunization Practices (ACIP) Recommendations*. Available at: http://www.cdc.gov/vaccines/pubs/ACIP-list.htm#hepb. Accessed September 14, 2011.
21. Smalligan RD, Lange WR, Frame JD, Yarbough PO, Frankenfield DL, Hyams KC, 1995. The risk of viral hepatitis A, B, C, and E among North American missionaries. *Am J Trop Med Hyg 53:* 233–236.
22. Leder K, Chen LH, Wilson ME, 2012. Aggregate travel vs. single trip assessment: arguments for cumulative risk analysis. *Vaccine 30:* 2600–2604.
23. McMahon BJ, Dentinger CM, Bruden D, Zanis C, Peters H, Hurlburt D, Bulkow L, Fiore AE, Bell BP, Hennessy TW, 2009. Antibody levels and protection after hepatitis B vaccine: results of a 22-year follow-up study and response to a booster dose. *J Infect Dis 200:* 1390–1396.
24. Wilder-Smith A, 2008. Meningococcal disease: risk for international travellers and vaccine strategies. *Travel Med Infect Dis 6:* 182–186.

25. Kulshammer M, Winke U, Frank M, Skali-Lami U, Steudel H, Schilling G, Drexler JF, Eis-Hubinger AM, Matz B, 2013. Poor immunity status against poliomyelitis in medical students: a semi-anonymous study. *Med Microbiol Immunol (Berl) 202:* 63–65.
26. Alexander JP, Wallace GS, Wassilak SGF, 2012. Poliomyelitis. Brunette G, ed. *CDC Health Information for International Travel 2012*. Atlanta, GA: US Department of Health and Human Services, Public Health Service.
27. Gautret P, Tantawichien T, Vu Hai V, Piyaphanee W, 2011. Determinants of pre-exposure rabies vaccination among foreign backpackers in Bangkok, Thailand. *Vaccine 29:* 3931–3934.
28. Piyaphanee W, Shantavasinkul P, Phumratanaprapin W, Udomchaisakul P, Wichianprasat P, Benjavongkulchai M, Ponam T, Tantawichian T, 2010. Rabies exposure risk among foreign backpackers in Southeast Asia. *Am J Trop Med Hyg 82:* 1168–1171.
29. Plesner AM, 2003. Allergic reactions to Japanese encephalitis vaccine. *Immunol Allergy Clin North Am 23:* 665–697.
30. Altmann M, Parola P, Delmont J, Brouqui P, Gautret P, 2009. Knowledge, attitudes, and practices of French travelers from Marseille regarding rabies risk and prevention. *J Travel Med 16:* 107–111.
31. Arguin PM, Krebs JW, Mandel E, Guzi T, Childs JE, 2000. Survey of rabies preexposure and postexposure prophylaxis among missionary personnel stationed outside the United States. *J Travel Med 7:* 10–14.
32. Neuberger A, Zaulan O, Tenenboim S, Vernet S, Pex R, Held K, Urman M, Garpenfeldt K, Schwartz E, 2011. Malaria among patients and aid workers consulting a primary healthcare centre in Leogane, Haiti, November 2010 to February 2011—a prospective observational study. *Euro Surveill 16:* 19829.
33. Dahlgren AL, DeRoo L, Steffen R, 2006. Prevention of travel-related infectious diseases: knowledge, practices and attitudes of Swedish travellers. *Scand J Infect Dis 38:* 1074–1080.
34. Zuckerman JN, Hoet B, 2008. Hepatitis B immunisation in travellers: poor risk perception and inadequate protection. *Travel Med Infect Dis 6:* 315–320.