



# Vaccination and malaria prophylaxis among Greek international travelers to Asian destinations

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## KEYWORDS

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## Summary

**Background:** International travel is rapidly increasing worldwide, and the greatest increases have occurred in tropical and subtropical areas. The aim of the survey was to investigate the pre-travel health-seeking practices of travelers to Asian destinations.

**Methods:** A questionnaire-based survey was conducted at the Athens International Airport between the 1st of November 2011 and the 30th of April 2013.

**Results:** A total of 1666 adult travelers participated in the study, and 69.7% were men. The mean age of the participants was 39 years. Previous travel to tropical countries was reported by 69% of the participants. The most frequent destination was the Indian subcontinent (45.0%). The main reasons for travel were visiting friends and relatives (VFRs; 36.5%) and business (32.4%). Most of the participants traveled for <1 month (51.4%). Only 24.5% pursued pre-travel consultations. Vaccinations were administered to 14.4% of the participants, and of those, 77%, 73%, and 32.5% received hepatitis A, tetanus/diphtheria, and typhoid vaccines, respectively. Malaria prophylaxis was given to 12.2% of the participants. Logistic regression analysis revealed that being male and unemployed, having an elementary level of education, traveling to visiting friends and relatives, and short durations of travel were significant determinants of not seeking pre-travel consultations.

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*Conclusion:* Significant gaps were revealed in the vaccinations and malaria prophylaxes of travelers departing to Asia. Specific educational tools should be developed to improve the awareness of travelers to high-risk destinations.

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## Introduction

International travel is rapidly increasing worldwide, and the greatest increases have occurred in tropical and subtropical areas. During the last decade, international arrivals in the Asia-Pacific region have been well above the global average. International arrivals accounted for 21% of all arrivals in 2010, up from 16% in 2000 [1]. Travelers to developing countries can be exposed to various infectious agents and can facilitate their spread across borders. Two recent examples include the rapid worldwide spread of severe acute respiratory syndrome and influenza A (H1N1) [2,3].

Nearly 8% of travelers to the developing world require medical care during or after travel. The main diagnoses among ill returning travelers include systemic febrile illness with malaria, which is the most frequent cause, acute diarrhea, and dermatological disorders [4]. Among the 42,173 ill returning travelers observed between 2007 and 2011 at GeoSentinel clinics, 32.6% had traveled to Asian countries [5]. Vaccine-preventable diseases (VPDs) accounted for 1.5% of 37,542 ill returning travelers. Enteric fever, acute viral hepatitis and influenza were the most common diagnoses, and the factors associated with *Salmonella typhi* included travel to Asia [6].

Pre-travel consultation and the provision of general advice, vaccines and malaria prophylaxis can minimize the health risks of traveling. Previous studies have shown that travelers who seek pre-travel consultations have better risk perceptions regarding infections and exhibit higher levels of risk-reducing behavior [7–9]. Other studies have revealed that a large proportion of Western travelers do not receive health information [8–15]. Only 41.2% of Western that are ill following returning from Asian countries reported that they had a pre-travel visit [5]. Few other studies on the pre-travel health-seeking behavior of travelers to the Asia-Pacific region suggest that the proportion of Asian travelers who attend pre-travel consultations is even lower than that of Western travelers [14–17].

Studies about the knowledge, attitudes and practices of travelers to Asian destinations are lacking

in Greece. The purpose of the current study was to identify health-seeking practices and to determine the provision of vaccines and malaria prophylaxis among Greek travelers visiting Asia and departing from the Athens International Airport.

## Methods

A questionnaire-based survey was conducted from the 1st of November 2011 to the 30th of April 2013. Data collection was performed 2 days each week. Travelers leaving from the departure gates of the Athens International Airport were invited to participate in the survey. The inclusion criteria were being a Greek resident,  $\geq 19$  years old, and traveling to Asia or the Middle East. Travelers going to Australia, New Zealand and Japan were excluded from the survey. Therefore, only three airlines were selected. A total of 1666 adult travelers were studied. We sought to study 1500–2000 participants at the beginning of the study, which corresponds to approximately 10% of the total number of travelers to Asian destinations according to Hellenic National Statistics Authority data (personal communication). We aimed for a large sample size was to cover a wide range of destinations in our study. The travelers participated on a voluntary basis, and oral informed consent was obtained. Approval was given by the International Airport Authority, the airlines flying to the above destinations, and the Board of Directors of the Hellenic Center for Disease Control and Prevention.

Data was collected using a standardized anonymous questionnaire that was specifically designed in the Greek language. This questionnaire was administered by 4 trained interviewers and required approximately 10 min. The data included information about demographics, travel characteristics, and pre-travel consultations (vaccination, malaria prophylaxis, general preventive measures, and the source of any pre-travel consultation). Approximately 10 randomly selected travelers were interviewed each per visit in the waiting area for the airport gates according to the inclusion criteria and the selected flights. The interviews

were conducted twice weekly (~20 per week and ~90 per month throughout the study period).

High-risk areas and those with moderate to high prevalences of malaria were defined according to published sources [4,18–20]. The definition of high-risk travelers regarding exposure to malaria in endemic areas was also based on the travel characteristics. Adequate vaccines and malaria prophylaxis defined according to the National Hellenic Center for Disease Control and Prevention (HCDCP) guidelines, which are in accordance with the guidelines of the World Health Organization and the US Centers for Disease Control and Prevention [21–23]. Urban accommodation was defined as living in a city with a population of 5000 or more people, and rural accommodation was defined as living in a village with a population up to 5000 or residence in the countryside (Hellenic Statistics Authority: personal communication). Short-term travel was defined by trips of <1 month duration, and long-term travel was defined by trips of >1 month. An organized trip was defined as a guided, package trip, and these trips were primarily to popular tourist destinations. Outdoor activities included adventure sports, backpacking, hiking, and remote expedition. Travelers visiting friends and relatives (VFRs) were defined as immigrants to Greece who were returning to their homeland, which was lower-income country, to visit friends or relatives according to the definition outlined by the US Centers for Disease Control and Prevention (CDC) [24].

Chi-squared tests and Fisher's exact tests were used to compare the categorical variables. A standard multiple logistic regression was conducted (with the variables with *p*-values <0.15 in the univariate analyses) to examine the relations between pre-travel preparation and independent factors. Multivariate analysis was applied to identify the factors that influenced the decision to seek a pre-travel consultation. Odds ratios (ORs) and their 95% confidence intervals (CIs) were calculated. *P*-values of 0.05 or less were considered statistically significant. Unanswered items were excluded from the analyses. The analyses were performed using STATA v12.1 software.

## Results

A total of 1666 travelers participated in the survey (98% response rate) and included 1272 (76.4%) and 394 (23.6%) participants who were traveling to Asia and the Middle East, respectively (Table 1); 265 (67.3%) of the 394 travelers to the Middle East had an Asian country as a second destination.

**Table 1** Travel destinations of the international travelers departing to Asia and the Middle East from the Athens International Airport, 2011–2013 (*N* = 1666).

Geographical region <sup>a</sup>	<i>N</i> (%)
Indian subcontinent	750 (45.0)
Southeast Asia	441 (26.5)
Middle East	394 (23.6)
East Asia	79 (4.7)
Pacific	0 (0)
Unknown country	2 (0.2)

<sup>a</sup> 27 Travelers had more than one destination.

The four most common Asian destinations were India (18.7%), Pakistan (12.5%), Thailand (9.8%) and Bangladesh (9.2%). Fifty-two percent of all travelers visited malaria endemic areas.

Table 2 describes the travelers and their travel characteristics. The majority of the international travelers were male and of Greek nationality. Fifty-six percent of the travelers were traveling alone. More than one-third of the travelers were foreign born; 28.3% were born on the Indian subcontinent. Outdoor activities, contact with animals, and altitude exposure were reported by 221 (13.3%), 42 (2.5%) and 3 (0.18%) travelers, respectively. One-quarter of the travelers reported having sought a pre-travel consultation (Table 2). Of those traveling for leisure, for business and VFRs, 45.7%, 30.3% and 3.2% sought pre-travel advice, respectively (*p*-value < 0.001).

Vaccinations according to destinations are described in Table 3. A total of 575 vaccines were administered to 240 (14.4%) of the travelers (mean number of vaccines: 2.4; range: 1–14); 128 (53.3%), 109 (45.4%) and 3 (1.3%) travelers received routine, travel, and routine and travel vaccines, respectively. The vaccines that were most commonly administered were those for hepatitis A (77%), and tetanus/diphtheria (73%). More than 70% of the travelers visited areas that are endemic for hepatitis A, and nearly 50% of the travels visited typhoid fever endemic areas. The hepatitis A and typhoid vaccination rates were lower than expected (60% and 35%, respectively). Of the travelers to whom the typhoid vaccine was administered, 39.7% visited Southeast Asia, and 33.3% visited the Indian subcontinent; however, the typhoid vaccine was administered to only 3.5% and 7% of those traveling to the above destinations, respectively. Nearly all of the travelers who received yellow fever vaccines were sailors who were traveling to a second or third destination such as the sub-Saharan Africa.

Rabies vaccinations were administered to 0.4% of our travelers and were primarily given to those visiting the Indian subcontinent and Southeast Asia.

**Table 2** Travel and travelers' characteristics and pre-travel health information (N = 1666).

	N (%)
Gender	
Male	1162 (60.7)
Female	652 (39.3)
Age (years)	
19–34	535 (32.2)
35–49	923 (55.4)
50–64	186 (11.2)
≥65	22 (1.32)
Education	
University/tertiary	973 (59.0)
Secondary school	181 (11.0)
Elementary school	498 (30.0)
Employment	
Yes	1477 (88.7)
Previous travel to tropical or subtropical country	
Yes	1148 (68.9)
Duration of travel	
<1 month	856 (51.4)
1 to ≤3 months	386 (23.2)
3 to ≤6 months	162 (9.7)
>6 months	260 (15.6)
Unknown	2 (0.1)
Purpose of travel	
Visiting friends and relatives	608 (36.5)
Work	541 (32.5)
Recreation	442 (26.5)
Education	50 (3)
Religious reasons	17 (1)
Place of stay	
Local residence	862 (51.7)
Hotel	750 (45.0)
Ship	41 (2.5)
Camping	7 (0.4)
Other	5 (0.3)
Unknown	1 (0.06)
Area of stay	
Urban	1053 (63.2)
Urban & rural	477 (28.6)
Rural	122 (7.3)
Altitude >3000 m	0 (0)
Unknown	2 (0.1)
Time in which pre-travel health information was sought before the journey (d)	
Yes	393 (23.6) <sup>a</sup>
≤7	37 (22.2)
8–14	130 (7.8)
15–28	94 (5.6)
≥28	132 (7.9)
Sources of pre-travel health information	
Yes	424 (25.5)
HDCDCP	184 (11.2)

**Table 2 (Continued)**

	N (%)
Family doctor/health fund service	176 (11.2)
Public Health Department	164 (9.8)
Internet	112 (6.7)
Other doctor	21 (1.3)
Hospital/medical center	6 (0.4)

<sup>a</sup> Data was missing on this question.

Only 0.4% of the travelers to the Indian subcontinent, 0.16% of the travelers VFRs, and 0.4% of the long-term travelers were vaccinated against rabies despite traveling to rabies-endemic countries.

The malaria prophylaxes according to destinations are shown in Table 4. A total of 204 (12.2%) travelers were prescribed chemoprophylaxis; 6 of whom visited areas for which malaria chemoprophylaxis was not indicated. Among all of the travelers, 860 travelers visited malaria endemic areas, and 23% received chemoprophylaxis. Only 0.5% of the travels to VFRs and 50% of business travelers who traveled to malaria endemic areas were prescribed chemoprophylaxis. Atovaquone/proguanil was the most commonly prescribed antimalarial (68%).

There were statistically significant associations between malaria chemoprophylaxis, general advice, and destination. More of the travelers who traveled to Southeast Asia (20.9%) and the Indian subcontinent (10.7%) were prescribed chemoprophylaxis compared to the travelers to other destinations ( $p$ -value < 0.001), and 76% and 81% of these travelers received atovaquone and proguanil, respectively. In terms of the purposes of travel, more tourists (56.5%) and business travelers (42%) received antimalarials than did the travelers to VFRs (1.5%;  $p$ -value < 0.001).

Multivariate analysis was used to investigate the associations of several factors with the failure to pursue a pre-travel health consultation among the travelers to Asian destinations. Being male, unemployed, having an elementary level of education, traveling to VFRs, traveling for <1 month and traveling to the Middle East each predicted greater odds of not pursuing health information (Table 5).

## Discussion

The objective of the present survey was to provide a clear picture of Greek travelers visiting Asian countries and their practices in relation to the seeking of pre-travel health consultations. The results revealed that the overall levels of pre-travel

**Table 3** Vaccination according to destination<sup>a</sup> (N = 1666).

	N (%)			
	Indian subcontinent N = 750 (%)	South East Asia N = 441 (%)	East Asia N = 79 (%)	Middle East N = 394 (%)
<b>Routine vaccines<sup>b</sup></b>				
Hepatitis A	73 (9.7)	83 (18.8)	16 (20.3)	13 (3.3)
Tetanus–diphtheria	64 (8.5)	76 (17.2)	17 (21.5)	18 (4.6)
Hepatitis B	9 (1.2)	14 (3.2)	4 (5)	12 (3)
Poliomyelitis	6 (0.8)	2 (0.5)	0 (0)	8 (2)
Measles–Mumps–Rubella	7 (0.9)	6 (1.4)	0 (0)	2 (0.5)
Influenza	3 (0.4)	0 (0)	0 (0)	3 (0.8)
Pneumococcal	1 (0.1)	0 (0)	0 (0)	0 (0)
<b>Travel vaccines</b>				
Typhoid fever	26 (3.5)	31 (7)	10 (12.6)	11 (2.8)
Cholera	4 (0.5)	2 (0.5)	0 (0)	0 (0)
Yellow fever	4 (0.5)	4 (0.9)	3 (3.8)	13 (3.3)
Meningococcal (A,C, W135, Y)	1 (0.1)	0 (0)	3 (3.8)	17 (4.3)
Rabies	3 (0.4)	3 (0.7)	1 (1.3)	0 (0)
Tick-born encephalitis	0 (0)	0 (0)	0 (0)	0 (0)
Japanese encephalitis	1 (0.1)	0 (0)	0 (0)	0 (0)

<sup>a</sup> The destinations of 2 travelers were unknown.

<sup>b</sup> In accordance with the National Vaccination Program of Greece.

health seeking, vaccinations and malaria chemoprophylaxis were low. However, the profile of the responders suggests that they were receptive to awareness regarding health prevention because one-third were travelers with tertiary levels of education, jobs, and histories of previous travel to developing countries.

Travel medicine providers were particularly underutilized; only 25.5% of the travelers reporting having sought pre-travel consultations in the current survey. This finding is comparable to the rates that have been reported in similar studies [8–17,25]. Those traveling for leisure and for business were more likely to pursue health information than those traveling to VFRs.

The results of the present survey revealed that the proportion of travelers traveling for work purposes or to VFRs was greater and the proportion of travelers who were traveling for leisure was

lower than the proportions that have been reported in other studies [8,11,12,14,25]. Those traveling to VFRs predominantly visited the Indian subcontinent, the business travelers predominantly visited the Middle East (most had East Asia as a second destination) and East Asia, and those who traveled for recreation predominantly visited Southeast Asia. A change in the demographic pattern of Greek travelers to developing countries was shown in the current survey relative to previous studies [26], which might reflect the influence of the economic crisis in Greece on immigration and international travel; there have been gradual increases in the proportion of travelers who are traveling to VFRs and business travelers and a decrease in the number of people traveling for recreation. However, according to a recent Greek study, only 24.7% of all business travelers going to developing countries are vaccinated [27].

**Table 4** Malaria chemoprophylaxis according to destination (N = 1666).<sup>a</sup>

Type of chemoprophylaxis	N (%)			
	Indian subcontinent (N = 750)	South East Asia (N = 441)	East Asia (N = 79)	Middle East (N = 394)
Mefloquine	15 (2)	18 (4.1)	6 (7.6)	21 (5.3)
Atovaquone/proguanil	65 (8.7)	70 (15.9)	2 (0.5)	2 (0.5)
Doxycycline	0 (0)	4 (0.9)	0 (0)	0 (0)
Chloroquine	0 (0)	0(0)	0 (0)	0 (0)

<sup>a</sup> A total of 204 (12.2%) travelers were prescribed chemoprophylaxis.

**Table 5** Multivariate analysis of the factors that were associated with not pursuing health information among travelers to Asia and the Middle East.

Characteristics	OR (95% CI)	p-Value
Gender		
Male vs. female	1.55 (1.14–2.10)	0.005
Education level		
Elementary school vs. tertiary level of education	5.74 (2.99–11.03)	<0.001
Secondary school vs. tertiary level of education	1.53 (0.95–2.46)	0.084
Purpose of travel		
VFRs (visiting friends and relatives) vs. traveling for recreation	4.76 (2.76–8.24)	<0.001
Duration of travel		
<1 month vs. >6 months	2.12 (1.52–2.94)	<0.001
Unemployment vs. employment	2.16 (1.19–3.94)	0.012
Traveling with someone		
Husband/wife vs. single	1.57 (1.04–2.35)	0.030
Friends and relatives vs. alone	1.99 (1.31–3.02)	<0.001
Destination		
Middle East vs. the Indian subcontinent	4.73 (3.34–6.72)	<0.001

Although the vaccination rate in the current survey was low, it is comparable to the results of other studies [8,12,14,15]. The hepatitis A vaccine was the most prevalent vaccine delivered. Similarly, this was found to be the most common vaccine administered in a United States study and in two Australian studies, which also reported similar rates [8,10,14,15]. However, the vaccination rate for hepatitis A was lower than expected as indicated by retrospective analyses of travel and the travelers' characteristics. This finding might be attributable to the travelers' lack of knowledge about high-risk destinations [25] and possible pre-existing immunities [28]. The typhoid vaccine was delivered to less than 5% of the travelers; this rate was lower than those reported in other studies [8,15]. Although those traveling to VFRs accounted for more than one-third of the travelers, and their main destination was the Indian subcontinent, only a few had received a typhoid fever vaccine. Retrospective analyses based on travel and the travelers' characteristics revealed that the rate of vaccination rate against typhoid fever was lower than expected (35%). The low rate of vaccination against rabies might be related to the travelers' and travel health providers' lack of knowledge about the risks of rabies exposure, as shown in a recent study from Greece, and to the time between consultation and departure [29,30].

Although the importation of vaccine-preventable diseases has been recognized as an important travel-related problem [6], in this study, the rates of routine vaccinations were low; however, the rate of vaccination against tetanus/diphtheria was comparable to the rates that have been reported in

other studies [10,15]. Low rates of routine vaccinations might be related to previous vaccination coverage through the National Vaccination Program of Greece, which is provided by health professionals other than travel health consultants [31].

The rate of malaria prophylaxis in the current study was lower than those reported in other studies [8,10,12,15,32]. Retrospective analyses of the data revealed that less than one-quarter of all travelers who visited malaria endemic areas, such as the Indian subcontinent and Southeast Asia, received chemoprophylaxis. Only a few of those traveling to VFRs and approximately half of the business travelers who traveled to malaria endemic areas were prescribed chemoprophylaxis. The results of this survey suggest that the rate of malaria prophylaxis was below the expected rate, particularly among special groups, such as those traveling to VFRs and business travelers. These findings might be attributable to a lack of awareness about the risks of the disease among the travelers [26,32–36].

A number of factors, such as being male and unemployed, having an elementary level of education, visiting friends and relatives, traveling for short durations and traveling alone, predicted a reduced likelihood of pursuing health information prior to departure.

Our study has several advantages. The Athens International Airport is the largest airport in Greece in terms of passenger volume and the number of flights; therefore, most international travelers to destinations other than European countries depart from this airport. This survey was carried out over 18 months and covered all of the seasons.

However, the current survey has some limitations. Data regarding the time between pre-travel preparation and departure were not available for more than half of the travelers. Because limited time between consultation and departure might be a contributing factor to low vaccination rates, this lack of data might constitute a limitation of our analysis.

## Conclusions

In summary, we found considerable shortcomings in pre-travel health-seeking among travelers departing to Asian destinations in terms of vaccinations and malaria prophylaxis. The small number of travelers who sought pre-travel advice and the inadequate vaccine and malaria prophylaxis statuses of those traveling to high-risk destinations suggest that public health strategies are needed to improve public awareness about the health risks of travel. Initiatives that target all groups of travelers, particularly high-risk groups, such as travelers to VFRs and business travelers, are needed. Travel health providers should increase their training and education efforts to improve awareness and to encourage safe and healthy travel.

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