

Preparedness against self-infection and importation of Malaria - An airport survey among Saudis traveling to endemic countries

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ABSTRACT

Background: Infected travelers returning from malaria endemic countries pose the threat of local outbreaks in nonendemic countries. Such outbreaks are becoming potential public health threats with increasing volume of international travels. **Aims:** This study aimed to assess the knowledge, attitude, and practices toward malaria, its prevention and treatment among Saudi air travelers visiting malaria-endemic countries. **Methods:** A cross-sectional survey was conducted among Saudi passengers who were waiting at the departure gates of the King Khalid International Airport, Riyadh to travel to five chosen malaria-endemic countries. Knowledge, attitude, practice, and health-seeking behavior for malaria were assessed using a self-administered questionnaire. Factors associated with favorable responses were identified by statistical tests. **Results:** Among 531 travelers, adequate knowledge, favorable attitude, and healthy practices pertaining to malaria were present in 42.7%, 80.2%, and 55.7%, respectively. Traveling to India, age ≥ 30 years, tourists and traveling businessmen, previous visit to same country or region, seeking malaria-specific advice were significantly associated with adequate knowledge. Only 11.3% had sought pretravel health advice on malaria. Lack of knowledge about the existence and importance of pretravel consultation was the common reason for not seeking advice. **Conclusion:** Knowledge about malaria and practice of preventive measures were suboptimal among Saudi travelers. Public awareness about travel consultation and chemoprophylaxis should be a part of malaria elimination and prevention efforts. Primary care physicians should take into account the level of knowledge among prospective travelers and provide opportunistic travel health services or refer them appropriately.

Keywords: Knowledge attitude and practice, malaria, Saudi Arabia, travel health

Background

Malaria is a global health issue that has been a persisting challenge to public health threat for several decades. Over 200 million cases of malaria and about 400,000 malaria deaths occurred worldwide in 2015.^[1] The centers for disease control and prevention (CDC) lists around 100 malaria-endemic countries with varying transmission risks from high to very low.^[1] On the

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contrary, nonendemic countries are faced with the major problem of imported malaria. Local mosquitoes can become vectors and transmit malaria by biting returning infected travelers and infect local residents. This has been demonstrated in several outbreaks in the United States (US) between 1957 and 2015.^[1] To prevent this, CDC recommends malaria prophylactic measures for travelers according to the risk level of the destination country.^[1] However, adherence to these measures is neither universal nor adequate among such travelers.

Saudi Arabia is one of the largest outbound travel markets for the Muslim millennial. In line with the predicted enormous increase in foreign travels, worldwide,^[2] the MasterCard-Halal Trip Muslim Millennial Travel Report 2017 (MMTR) described the Muslim millennial as a 'fast-growing' market.^[3] A total of 4 out of the top 10 favorite destinations listed in the MMTR report are malaria-endemic countries.^[1]

Imported malaria is a concern in the malaria-free Middle Eastern countries. Qatar reported 438 cases of imported malaria from 2004 to 2006,^[4] and noted that none of the diagnosed cases obtained pretravel consultation nor used malaria chemoprophylaxis.^[5] Jordan reported 511 cases between 1991 and 2011 among returning Jordanian travelers, 33.2% of whom were students.^[6] A 2015 cohort study conducted in Kuwait reported a significant association between nationality and the tendency to visit a travel health clinic. They also found that Africa was the most popular destination for the study participants.^[7] A Saudi study conducted in 2003 assessed the epidemiology of imported malaria in Riyadh and found that among the 1,272 cases, 36.6% were of Saudi nationality.^[8]

Visiting a specialized health-care provider before an international trip is very important, as individualized risk assessment can balance the benefits of chemoprophylaxis and the possibility of their side effects.^[1] Although 61% of Muslim millennial spend between 1 and 6 months in planning a trip,^[3] there is little to no data presented on whether travel health and pretravel medical consultation are sought by them.

Preventing every potential exposure to malaria and averting every imported case is vital. It is essential to empower the Saudi society with the right information about risks of travel-related malaria transmission and the availability of protective measures. This need assumes greater importance with the predicted increase in the numbers of Saudi travelers and their interest in more diverse and exotic destinations.^[3] Therefore, this study aimed to assess the knowledge, attitude, and practices toward the prevention and control malaria among adult Saudi air travelers who were visiting malaria-endemic countries.

Objectives

This study aims to assess the knowledge about the risk of malaria transmission and malaria prophylaxis among adult Saudi air travelers traveling to malaria endemic countries; to assess the

attitude and practice with regard to traveling to malaria endemic countries among adult Saudi air travelers; and to describe the common sources of health information sought by adult Saudi air travelers before traveling to malaria endemic countries.

Methods

Ethical Approval was obtained from the Ethical Committee of the Ministry of Health, Kingdom of Saudi Arabia on May 30, 2018. Five countries were chosen from the CDC list,^[1] to represent the different levels of risk of malaria transmission in this study. These were one high-risk country (Sudan), one moderate-risk country (India), and three low-risk countries (Malaysia, Indonesia, and South Africa). These choices were based on popular Saudi tourists' destinations as identified by the Saudi Travelers Director General and the MMTR of 2017.^[3,9] Additionally, Sudan was chosen because it is a highly endemic country that is frequently visited by businessmen and government agencies for recruiting manpower.

A modified version of the European Travel Health Advisory Board questionnaire translated into Arabic was used.^[10] The original version was modified by removing 10 items and adding seven new questions. The new questions enquired about having chronic diseases, receiving specific advice about malaria, HIV, hepatitis and yellow fever, knowledge about malaria, its transmission, fatality and preventability, and whether the traveler was consuming malaria chemoprophylaxis tablets. The face validity of the tool was verified by a panel of public health and malaria experts working in the ministry of health and questions were modified accordingly. An independent language expert translated the English version into Arabic, which was then back translated to English to ensure that the original intended meaning was preserved. This translated version was then piloted among a group of volunteers.

The sample size calculated for an assumed proportion of 84% (proportion of travelers who had adequate knowledge regarding malaria according to a previous study),^[11] a precision of 3.5%, an alpha of 5%, and a nonresponse rate of 20% was 531. Consecutive sampling technique was used to survey eligible travelers between July and August 2018 till the sample size was achieved. Subjects, who were not able to fully comprehend the questions or provide consent as a result of illness, having a mental illness or having special needs and travelers in the executive lounges were excluded. Eligible Saudi travelers aged 18 years and above were approached at the departure gates at King Khalid International Airport (KKIA) in Riyadh. Mobile applications of online ticketing agencies and the official app of the KKIA were used to identify flight schedules to the chosen countries and visit the airport at the appropriate times.

Data were collected in paper forms and entered into Microsoft Excel and analyzed using SPSS v. 20 (SPSS Inc., IBM, Armonk, New York, USA). Five domains of knowledge were assessed, namely, malaria risk, symptoms, mode of transmission, fatality,

and preventability. Ideally, travelers were expected to recognize that they were visiting a malaria-endemic country, to identify malaria symptoms, recognize mosquitos as the cause of transmission, and know that malaria can be fatal but preventable. Knowledge about symptoms was considered adequate if the traveler knew at least four out of five major symptoms. Overall, knowledge was considered adequate if a traveler had adequate knowledge in four out of the above five domains. Attitude was assessed based on the response to questions on probable mosquito prevention measures. If a traveler expressed good attitude in at least one major outdoor measure (covering arms/legs, using mosquito repellent), the outdoor attitude was considered good. If a traveler expressed good attitude in at least one major indoor measure (closing doors and windows at night, using insecticide plug-in or spray inside the room), the indoor attitude was considered good. A good overall attitude required good outdoor and indoor attitude. Practice was assessed in two domains - taking malaria chemoprophylaxis and packing of personal protective items for mosquito bite prevention. Using malaria chemoprophylaxis tablets before departure or packing the tablets was considered good chemoprophylaxis practice. Packing insecticide room spray or mosquito nets or mosquito repellent was considered good packing practice. A good overall practice required a good chemoprophylaxis practice or a good packing practice. Descriptive analysis was done and categorical variables were expressed as frequencies and percentages. Factors associated with adequate knowledge, attitude, and practice were assessed using Chi-square tests. A *P* value of < 0.05 was considered to be statistically significant.

Ethical clearance for the study was obtained from the institute review board of the Ministry of Health and permission to conduct the study within the airport was obtained from the competent authorities. Written informed consent was obtained from all travelers before administering the questionnaire. Any traveler who requested information on malaria and other infectious diseases was directed to appropriate resources.

Results

Among the 531 surveyed travelers, more than half were males (59%). Young adults aged 18--29 years old accounted for 52.5%. Most of the participants were healthy (80.2%), while 19.8% had at least one chronic illness such as diabetes, hypertension, heart disease, or others. Traveling with the whole family was the most common practice (44.8%), followed by traveling with the spouse (26.2%) and friends (17.3%). A majority of the travelers organized their trip 1 to 2 months in advance (36.3%). The most common purpose of travel was stated as tourism (88.5%) followed by education or research (4.3%) and business (4.1%). Among the travelers who were visiting only one country, 68.3% were first-time visits, 52.6% were planning to stay for 7--14 days, and 74.6% in urban areas. A small minority of 40 travelers (7.5%) was visiting more than one malaria-endemic country during their trip. More than a third (39.1%) had visited another country in the same region before. The low-risk countries

were the most popular among the five chosen countries in this study, 40.7% of the participants were visiting Indonesia, 36.5% Malaysia, 12.6% South Africa [Table 1].

Travel-related health information was sought by 11.3% and 5.7% received specific advice about malaria. Most commonly, 28.6% sought this advice 1--2 months before the travel. Internet was the most common source of health information (46.7%). Among the 470 travelers (88.7%) who did not seek any travel health information, 41.4% reported that they 'didn't know it was important' and 30.1% 'didn't know it existed' while 13.9% felt that they 'won't be at risk' [Table 2].

Knowledge

Majority of the participants (73.2%) knew that malaria was preventable, 65.3% recognized at least four common symptoms, 62.9% knew that malaria can be fatal, and 56.1% knew that

Table 1: Sociodemographic and travel-related characteristics of Saudi air travelers to Malaria endemic countries (n=531)

		No.	Percentage
Age category	18--29 years	268	52.5
	≥30 years	242	47.5
Gender	Male	312	59.0
	Female	217	41.0
Chronic disease	None	426	80.2
	Any chronic disease	105	19.8
Traveling companion	Alone	37	7.0
	Partner/spouse	139	26.2
	With the whole family	238	44.8
	With friends	92	17.3
	With colleagues	15	2.8
Purpose of the visit	Others	17	3.2
	Visited any other country in this region previously	204	39.1
	Tourism or holiday	470	88.5
	Business or work related	22	4.1
	Visit to family or friend	6	1.1
	Research or education	23	4.3
	Others	27	5.1
Duration of trip planning	Less than 1 week	44	8.4
	1--2 weeks	70	13.4
	2 weeks to 1 month	114	21.8
	1 month to 2 months	190	36.3
Visiting country	More than 2 months	105	20.1
	Sudan	32	6.0
	India	72	13.6
	South Africa	67	12.6
	Malaysia	194	36.5
Number of countries visited	Indonesia	216	40.7
	One	491	92.5
	More than one	40	7.5
	Visited this country previously*	128	31.7
Visited this region previously	204	39.1	

Note: *Only among travelers who were visiting one country (n=491)

malaria was transmitted by mosquito bites. Only 32% recognized that they were visiting a malaria endemic area. The overall knowledge was adequate in 42.7% of the travelers [Table 3].

Traveling to India ($P=0.018$), travelers aged ≥ 30 years ($P=0.004$), tourists and traveling businessmen ($P < 0.05$), a previous visit to the same country ($P = 0.027$) or the same region ($P = 0.002$), seeking information or advice ($p < 0.001$), and receiving malaria-specific advice ($p < 0.001$) were significantly associated with adequate knowledge [Table 4].

Attitude

With regard to outdoor behavior, most travelers planned to wear clothes to cover arms and legs (76.5%), to apply mosquito repellent to uncovered skin (71.6%), to not use perfumes or aftershave (65%), and to not use deodorant in open areas (52.5%). The overall attitude toward outdoor protective behavior was adequate in 88.3%. For indoor behavior, most planned to keep windows and doors closed at night (73.1%), to use (insecticide room spray, plug-in mosquito repellent, mosquito coil) (76.5%), to turn on air conditioner (71.4%), and to sleep under a mosquito net (64.8%) and the overall indoor behavioral attitude was good in 85.5%. The combined overall favorable attitude was reported by 80.2% [Table 3].

Among the five chosen countries in this study, traveling to Malaysia was associated with good overall attitude ($P = 0.01$); however, traveling to Sudan was associated with poor attitude ($p < 0.001$). Traveling for vacation ($p < 0.001$), traveling for research/educational purposes ($p < 0.001$), and a previous visit to the same region were significantly associated with a good attitude ($p < 0.001$) [Table 4].

	No.	Percentage
Sought health information/advice before this trip	60	11.3
Received specific advice about Malaria prevention	30	5.7
Time of seeking advice*		
Less than 1 week	8	14.3
1--2 weeks	12	21.4
2 weeks to 1 month	13	23.2
1--2 months	16	28.6
More than 2 months	7	12.5
Source of the health information/advice#		
Internet	28	46.7
Family or friends	23	38.3
Airline or travel agent	16	26.7
Doctor	12	20.0
Books/brochures/articles	11	18.3
Ministry sources	9	15.9
Reason for not seeking information/advice		
I didn't know it was important	187	41.4
I didn't know it existed	136	30.1
I knew what to do	88	19.5
I won't be at risk	63	13.9
I was too busy	60	13.3

Note: *Time before departure, #Multiple choice question

Practice

Mosquito protection items were packed by 54.8%; 62.2%, an insecticide room spray, 53% a mosquito net, and 65.5% a mosquito repellent. Only 10 travelers (2%) had packed malaria chemoprophylaxis tablets with them and 7 (1.3%) had started using the tablets before departure - overall 2.4% had good chemoprophylaxis practice. Overall, 55.7% had a good practice. [Table 3] Among the travelers who had not packed malaria chemoprophylaxis tablets, the most common reason given was “not knowing about the tablets” (80.8%).

Traveling to Malaysia and Indonesia was statistically associated with good overall practice. On the contrary, traveling to Sudan ($P=0.001$) and South Africa ($P=0.006$) was associated with poor practice. Previous visits to the same region ($P = 0.012$) as well as receiving malaria-specific advice ($P = 0.006$) were significantly associated with good practice [Table 4].

Discussion

This study presents one of the first accounts of knowledge, attitude, and practices regarding malaria, its transmission, prevention, and control among Saudi travelers traveling to endemic countries.

Only a minority (11.3%) of the travelers in the present study sought travel-related health information or advice before their trip, which is lesser than previously reported results in other parts of the kingdom.^[12] Higher percentages than the current study were reported from neighboring Gulf countries like Dubai (22.8%) and Oman (37.1%).^[13,14] Better health-seeking behavior was also reported among Asian and European travelers - 38.7% in Japanese travelers,^[15] 65.5% in Dutch travelers,^[16] and 92.8% in Portuguese travelers.^[11]

In the current study, among those who did not seek advice, lack of awareness was the major reason; while 41.4% were not aware of its importance and 30.1% did not know it existed. Misconceptions regarding travel health among Saudi travelers

	No.	Percentage
Knowledge	Risk of malaria	170 32.0
	Symptoms of malaria	347 65.3
	Mode of malaria transmission	295 56.1
	Fatality	332 62.9
	Preventability	386 73.2
Overall knowledge	223	42.7
Attitude	Outdoor attitude	469 88.3
	Indoor attitude	454 85.5
Overall attitude	426	80.2
Practice	Packing tablets	291 54.8
	Chemoprophylaxis consuming	13 2.4
Overall practice	296	55.7

Table 4: Factors associated with malaria-related knowledge, attitude, and practice among Saudi air travelers to Malaria endemic countries (n=531)

	Total		Knowledge		Attitude		Practice	
	No.	Percentage	No.	Percentage	No.	Percentage	No.	Percentage
Age category								
18--29 years	268	52.5	97	45.3**	213	79.5	148	55.2
≥30 years	242	47.5	117	54.7	198	81.8	138	57.0
Gender								
Male	312	59.0	131	59.3	244	78.2	167	53.5
Female	217	41.0	90	40.7	180	82.9	128	59.0
Chronic disease								
None	426	80.2	173	77.6	341	80.0	241	56.6
At least one disease	105	19.8	50	22.4	85	81.0	55	52.4
Visiting country								
Sudan	32	6.0	9	4.0	11	34.4***	9	28.1***
India	72	13.6	39	17.5*	58	80.6	43	59.7
South Africa	67	12.6	32	14.3	58	86.6	27	40.3**
Malaysia	194	36.5	87	39.0	167	86.1**	119	61.3*
Indonesia	216	40.7	79	35.4	179	82.9	132	61.1*
Previous visit								
To the same region	204	39.1	103	47.0**	183	89.7***	128	62.7*
To the same country	128	31.7	63	49.6*	111	86.7	78	60.9
Purpose of travel								
Tourism or holiday	470	88.5	190	85.2*	389	82.8***	263	56.0
Business or work abroad	22	4.1	14	6.3*	16	72.7	14	63.6
Visit family or friend	6	1.1	5	2.2*	5	83.3	3	50.0
Research or education	23	4.3	11	4.9	11	47.8***	9	39.1
Others	27	5.1	16	7.2*	21	77.8	16	59.3
Duration of trip planning								
Less than 1 week	44	8.4	14	6.3	26	59.1	24	54.5
1--2 weeks	70	13.4	33	14.9	51	72.9	34	48.6
2 weeks to 1 month	114	21.8	54	24.4	97	85.1	60	52.6
1 month to 2 months	190	36.3	74	33.5	162	85.3	106	55.8
More than 2 months	105	20.1	46	20.8	84	80.0	67	63.8
Sought health information/advice before this trip								
No	470	88.7	183	82.1***	373	79.4	255	54.3
Yes	60	11.3	40	17.9	52	86.7	40	66.7
Received specific advice about Malaria prevention								
No	500	94.3	196	87.9***	397	79.4	271	54.2**
Yes	30	5.7	27	12.1	28	93.3	24	80.0
Time of seeking advice								
Less than 1 week	8	14.3	3	8.1*	6	75.0	5	62.5
1--2 weeks	12	21.4	9	24.3	11	91.7	6	50.0
2 weeks to 1 month	13	23.2	12	32.4	12	92.3	10	76.9
1 month to 2 months	16	28.6	8	21.6	12	75.0	12	75.0
More than 2 months	7	12.5	5	13.5	7	100.0	5	71.4

Note: P value *** < 0.001, ** < 0.01, * < 0.05

had been documented in previous studies as well- 64.7% believed that there is no relation between infectious diseases and traveling and 37.6% did not believe that malaria chemoprophylaxis is effective.^[12] Similarly, lack of awareness was the reason cited by 32.4% of Japanese travelers^[15] and 44% of Dubai travelers for not seeking advice,^[13] while 59% of Omani travelers^[14] did not know where to get health advice.

Deficiencies in the travel health services such as lack of specialists and travel clinics along with the lack of awareness regarding

travel health in the community might explain the large reliance on the internet by a majority of the Saudi travelers as a source of pretravel health information. This percentage was higher than that reported in Oman (35%).^[14] In contrast, travel clinics were the most common source of advice among Dutch travelers^[16] and Turkish business travelers.^[17]

The predicted risk of exposure to malaria is an important factor to encourage travelers to seek advice or search for health information. Nevertheless, only a third (32%) of Saudi travelers

in the present study recognized that they were visiting a malaria endemic area. Similar lack of risk perception has been observed among Turkish travelers,^[17] as 80% did not know if malaria was a risk at their destination and among Egyptian travelers,^[18] as 47.5% did not perceive any travel-associated risks.

Other domains of knowledge were slightly better than risk perception, as 56.1% of participants knew the correct mode of malaria transmission compared to 40% in an older Saudi study.^[12] However, this could be explained by the difference in demographic and geographic aspects, as the present study included participants heading to malaria endemic areas from KKIA in Riyadh, whereas the other included all international travelers from King Abdul-Aziz international airport (KAA) in Jeddah and King Fahad International airport (KFA) in Dammam.^[12]

The overall knowledge was adequate among 42.7% of participants, which was very poor compared to other studies. For example, in an Omani study, 78% had excellent or good knowledge.^[14] Much better results were reported by a Portuguese study where travelers to a highly malaria endemic area had an overall knowledge score of 84.6%.^[11]

As reported previously,^[12] increasing age was associated with higher knowledge score, which is expected because they might have had previous exposures to such travel health information through their travels. However, the role of a traveling companion and pre-existing health status was not significant in the present study.

The measured attitude of the travelers in the present study was much better than their level of knowledge, which was the opposite of that reported among Portuguese travelers for instance.^[11] The planned personal preventive measures and behaviors in this study were better than what was reported in China.^[19] Although some of these attitudes like covering arms and legs, closing windows and doors and turning on air conditioning can be attributed to religious, cultural, habitual reasons, and not practiced for health protection or disease prevention reasons. Moreover, this good overall attitude score may be explained by social desirability bias, the tendency to report the correct healthy behaviors rather than reality, which were also reflected in our finding that practice was reported to be more or less satisfactory.

Only half of our study participants packed mosquito bites protective items with them, which was very poor compared to other studies.^[11,20,21] Nevertheless, it was somewhat better than the poor packing and use of malaria chemoprophylaxis tablets, which was not surprising considering the minority who sought health consultation from a health provider. This finding is in line with the underutilization of malaria chemoprophylaxis among international travelers that has been previously reported.^[22] Lack of awareness of the risk from the travelers' side and the missed opportunity from clinician's side are considered major reasons for this behavior.^[22]

The importance of this study is amplified by the fact that one of the most frequently travelled destinations, Sudan, is also facing drug resistance problems.^[23] Although Saudi Arabia is a low prevalence country there is evidence that the threat of imported malaria is real not only in this country but elsewhere also.^[24-26] Keeping all these considerations in context, it is high time that the nation prioritizes the elimination efforts toward Malaria.

Strengths and limitations

To the best of our knowledge, this study is the first to explore travelers' knowledge and practices specific to malaria in Saudi Arabia. The findings of this study are more relevant because the participants were selected in such a way that they were traveling to known endemic countries and as such the results are very specific. Our study also included a relatively large and representative sample of travelers making the results much more valid and credible than previous attempts in Saudi Arabia. The findings of this study will serve as an important link in the planning for prevention and control of imported malaria in Saudi Arabia and will inform the appropriate authorities for taking informed decisions.

However, this study was limited in place and time, as it was conducted in a single international airport during only one season. This could have influenced the travel destinations and the profile of travelers included in the study. Future research should be conducted in a large sample of international airports in Saudi Arabia, including more endemic destinations and covering different seasons of the year.

Conclusion

Malaria transmission in nonendemic countries such as Saudi Arabia is a threat to public health. With the current trends in globalization and the increased volume of international travels, this issue needs to be addressed adequately and quickly. This study shows that the general awareness among Saudi air travelers to endemic countries about malaria is suboptimal.

Recommendations

The findings of this study provide evidence to create and plan educational interventions for the public, in order to increase awareness and promote a healthy attitude and practices. Moreover, increasing the access to the available travel health services should be a part of these plans. As a next step, effective prevention and control strategies inclusive of, but not limited to, public awareness generation and scaling up of travel health services should be planned. This activity has to be undertaken by multiple stakeholders including ministries of health, foreign affairs, civil aviation, and travel medicine clinics. The findings of this study will help primary care physicians to understand the level and need for travel health-related knowledge among patients who will be travelling to Malaria endemic countries. These physicians should take into account the level of knowledge among patients who are also prospective travelers and provide

opportunistic travel health services or refer them appropriately. In a primary care setting, this intervention will greatly help efforts to prevent the risk of imported Malaria and the local outbreaks in Saudi Arabia.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There is no conflicts of interest.

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