

**Original Article****Epidemiology of Malaria in the State of Qatar, 2008-2015**

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Abstract. Background and Objectives. Imported malaria poses a serious public health problem in Qatar because its population is “naïve” to such infection; where local transmission might lead to serious, life-threatening infection and might even trigger epidemics.

Methods. This study is a retrospective review of the imported malaria cases in Qatar reported by the malaria surveillance program at the Ministry of Public Health (MoPH), during the period between January 2008 and December 2015. All cases were imported and underwent parasitological confirmation through microscopy.

Results. A total of 4092 malaria cases were reported during 2008-2015 in Qatar. The demographic features of the imported cases show that the majority of cases were males (93%), non-Qatari (99.6%), and aged 15 to 44 years (82.1%). Moreover, *P. vivax* was found to be the main etiologic agent accounting for more than three-quarters (78.7%) of the imported cases. In addition, almost a third (33.1%) of the cases were reported during the months of July, August, and September.

Conclusions. Imported malaria in Qatar has witnessed an increase during the past seven years, despite a long period of constant reduction; where the people most affected were adult male migrants from endemic countries. Many challenges need to be overcome to prevent the reintroduction of malaria into the country.

Keywords: Epidemiology, Malaria, Qatar.

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Introduction. The global importance of malaria is immense. It is the most prevalent vector-borne disease in the world, threatening some 2-3 billion people in more than 90 countries - 56% of the world's population. In 2016, the World Health Organization estimated that there were 216 million

malaria cases and 445 000 deaths attributable to malaria.¹ Most of these deaths occurred in the African region (91%), followed by the South-East Asian region (7%) and the Eastern Mediterranean region (2%).² The vast majority of deaths occurred among young children; other high-risk groups

included pregnant women, non-immune travelers, refugees, displaced persons, and laborers entering endemic areas.³ It is a well-known fact that both tourists and visiting friends and relatives (VFR) are at high risk of malaria as they are less likely to use chemoprophylaxis.^{4,5} Moreover, those VFR are at an increased risk of travel-related diseases, have lower risk perception and awareness, don't seek pre-travel advice, and are more likely to reside in remote rural areas when compared with tourists to the same destinations.⁵

Qatar is a country (population 2,235,355 in 2015) located in the west of the Arabian Peninsula. Even though indigenous malaria transmission has been eliminated in the 1970s, the risk of imported malaria still exists due to the massive influx of migrant workers from the Indian subcontinent and Sub-Saharan Africa.^{6,7} Moreover, this influx has recorded a 9-fold increase between 1995 and 2014.⁸ Additionally, the potential of malaria reintroduction in the country exists due to the presence of two malaria vectors, namely: *A. stephensi* and *A. multicolor*. The incidence of malaria was found to be in a consistent decline from 1997 to reach the lowest rate in 2004 but then increased by more than two times in 2005 and 2006.⁷ In 2008, approximately 200-250 cases of imported malaria were reported, and *P. vivax* was the main etiologic agent. Furthermore, all the patients had a travel history to malaria-endemic countries as India, Pakistan, and Sudan.⁹ Consequently, imported malaria poses a serious public health problem in Qatar because the population is "naïve" to such infection; where local transmission might lead to serious, life-threatening infection and could even trigger epidemics.

Currently, information regarding malaria surveillance in Qatar is insufficient to provide a clear epidemiological picture necessary for the development of a national strategy to control malaria importation. Therefore, the country is at risk of such disease and requires robust surveillance and preparedness to address any potential outbreaks. Thus, in the present retrospective study, we build a record of data regarding the incidence of malaria in Qatar to stall the potential spread of this deadly infection in Qatar.

Materials and Methods. This study is a retrospective review of the imported malaria cases

in Qatar reported by the malaria surveillance program at the Ministry of Public Health (MoPH), during the period between January 2008 and December 2015. Hamad Medical Corporation (HMC) is the main health care facility catering for the population of Qatar and epidemiologically represents both locals and expatriates in the country; where the hematological laboratory at HMC is considered to be the national reference laboratory. All the malaria cases in the present study were reported from the highly specialized hospitals of HMC: Hamad General Hospital, Al-Wakrah Hospital, and Al-Khor Hospital. Other sources of malaria cases were Qatar's primary health care provider, Primary Health Care Corporation (PHCC), through its 23 centers as well as the hospitals and health centers of the private sector.

Malaria Case Management. In Qatar, the management of malaria cases is centralized under HMC, the main and government-based provider of secondary and tertiary care in the country. Malaria cases are typically seen in the emergency department and triaged accordingly as uncomplicated or complicated cases based on specific case definitions. Patients infected with *P. falciparum*/*P. vivax* having different clinical status are generally defined according to the World Health Organization guidelines.¹ Moreover, malaria cases are designated as severe (complicated) cases depending on certain laboratory (e.g. parasitemia > 5%, severe normocytic anemia of Hb < 5g/dl, renal impairment where serum creatinine > 265 µmol/l) and clinical (e.g. impaired consciousness or coma, multiple convulsions, pulmonary edema) findings. Accordingly, severe (complicated) malaria cases are admitted to the medical intensive care unit (MICU) or the short stay unit, while uncomplicated cases are managed in an outpatient setting. A variety of anti-malarial medications are prescribed, such as: Patients diagnosed with uncomplicated and complicated/severe *P. falciparum* infection were treated with chloroquine and quinine plus doxycycline (adults)/or clindamycin (children)/or artemether and lumefantrine combination, respectively. Chloroquine, followed by primaquine is recommended for patients with *P. vivax* malaria. Those with mixed infections are usually treated as *P. falciparum* malaria.

All samples undergo screening for the malaria parasite through microscopic examination with Giemsa staining of thin and/or thick blood films. Furthermore, the malaria focal point of MoPH's communicable disease control section conducted the epidemiological investigation and follow-up. All patients diagnosed with malaria were treated with anti-malarial medication as per the current guidelines for malaria treatment at HMC.

Results. A total of 4092 malaria cases reported during 2008-2015 were analyzed to describe the epidemiological features of imported malaria in the State of Qatar, using demographic profiling through parameters such as age, gender, nationality (either Qatari, or migrant expatriates who have lived in Qatar for at least 1 year), travel history, time of malaria reporting, and *Plasmodium* species.

All cases were imported and underwent parasitological confirmation through microscopy; where no relapses were reported. Additionally, all patients received anti-malarial treatment with no accurate information about how many people exactly received such treatment. Therefore, none of the malaria patients were followed-up for 28 days. Furthermore, twelve cases of complicated or severe malaria have been documented throughout 2014 and 2015, and one of them was fatal. The causative organisms in more than half of such cases were *P. falciparum* (58.3%), followed by *P. vivax* (33.3 %), and mixed infection (8.3 %).

The annual number of imported malaria cases in Qatar has nearly tripled from 216 cases in 2008 to 728 cases in 2013. However, the number of malaria cases has declined to reach 445 cases in 2015. The demographic features of the imported cases (**Table 1**) show that the majority of cases were males (93%), non-Qatari (99.6%), and aged 15 to 44 years (82.1%). In addition, almost a third (33.1%) of the cases were reported between July and September (**Figure 1**). Furthermore, between 2008-2009 and 2012-2015, *P. vivax* was found to be the main etiologic agent accounting for more than three-quarters (78.7%) of the cases. In addition, during the time above period, *P. falciparum* was found to be responsible for almost one-seventh (13.6%) of the cases. However, data on the causative *Plasmodium* species during 2010 and 2011 were not recorded and thus are not reported in this study.

A total of 1,816 malaria cases were reported

between 2013 and 2015 to the surveillance section at the Ministry of Public Health, Qatar. After

Table 1. Demographic profile of imported malaria cases between 2008-2015 in the State of Qatar.

		n=4092 (%)
Gender	Male	3808 (93)
	Female	284 (7)
Nationality	Qatari	14 (0.4)
	non-Qatari	4078 (99.6)
Age	<15	247 (6)
	15-29	1897 (46.4)
	30-44	1419 (34.7)
	>44	529 (12.9)
Malaria Species	<i>P. vivax</i>	2336 (78.7)
	<i>P. falciparum</i>	404 (13.6)
	Others	229 (7.7)
Season wise	January - March	547 (13.4)
	April - June	1158 (28.3)
	July - September	1548 (37.8)
	October - December	839 (20.5)

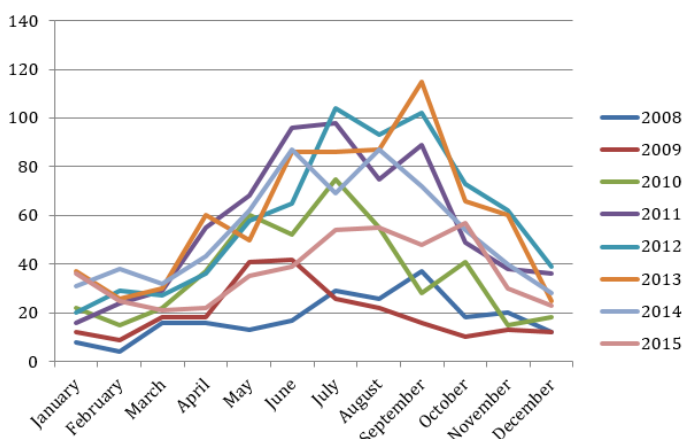


Figure 1. Monthly trends of reported malaria cases between 2008-2015 in the State of Qatar.

further analysis, the regional distribution of the cases' country of origin revealed that almost half originated from the South East Asia Region (44.7%) and the other half from the Eastern Mediterranean Region (43.2%) (**Table 2**). The distribution of malaria cases by nationality and country of origin reveal that all cases have contracted the malarial infection from patient's country of origin and due to travel to endemic countries.

Discussion. Malaria continues to be the most important vector-borne infectious disease and a major health problem in South East Asia and Africa. One of the main factors contributing to this sustained burden is the emergence and spread of

Table 2. Distribution of imported malaria cases according to *Plasmodium* species among different areas of origin between 2013-2015 in the State of Qatar.

Nationality	<i>Plasmodium</i> species				Total number of case
	<i>P. vivax</i>	<i>P. falciparum</i>	Mix	Others	
South East Asia Region [@]	776	28	5	3	812
African Region [#]	63	128	3	6	200
Eastern Mediterranean Region [§]	624	136	13	13	786
Western Pacific Region [%]	4	0	0	0	4
Region of the Americas [^]	2	2	1	0	5
European Region [*]	2	7	0	0	9
Total	1471	301	22	22	1816

[@]: India, Nepal, Sri Lanka, Myanmar, Indonesia. [#]: Cameroon, Chad, Eritrea, Ethiopia, Ghana, Guinea, Kenya, Mauritania, Mozambique, Nigeria, Uganda, Senegal, Sierra Leone, Tanzania, DR Congo, Gambia, Ivory Coast, Liberia, Mauritius, Rwanda. [§]: Afghanistan, Iran, Pakistan, Qatar, Sudan, Syria, Yemen, Oman, KSA. [%]: China, Philippines. [^]: Canada, USA. ^{*}: Great Britain, Belgium, Italy, Romania, Spain.

anti-malarial drug resistance as well as vector resistance to insecticides.¹⁰ In addition to that, increased international travel and dramatic climate changes have disturbed the conventional epidemiological pattern of endemic infectious diseases.

In the present study, the majority of cases were male, non-Qatari, presented at >15 years of age, *P. vivax* was the main etiologic agent and occurred between July and September; which corroborates with previous studies in Qatar^{7,9} and those of neighboring Gulf countries.¹¹⁻¹³ These data indicate that imported malaria in Qatar has shown an increase after a long period of constant reduction, and most cases occurred between July and September, which confirms that the infection was imported from patients' respected countries during the summer vacation.^{7,9} Furthermore, the reason of higher malaria cases in the male gender and 25 years old age group in the current study must be due to the massive influx of single male expatriates as labor from malaria-endemic regions of South East Asian Countries and African continents. This pattern has also been reported from previous studies in the Gulf region and western countries.^{11,13-15}

The Gulf Cooperation Council (GCC) countries have accomplished against malaria control; however, the region has witnessed the influx of a large immigrant workforce, which travels to and from the respective home countries annually. Moreover, such labor force arises primarily from the malaria-endemic countries of India, Pakistan, and Bangladesh. Therefore, imported malaria can pose a significant threat to malaria control programs and the prospect of elimination in some of GCC countries, where transmission has been

interrupted previously. In the United Arab Emirates, almost 3239 cases of imported malaria were identified; the majority of which (90%) originated from Pakistan and India. On the other hand, the Kingdom of Saudi Arabia reported 1912 cases of imported malaria; almost a third of which (30%) originated from neighboring Yemen. In addition to that, the majority (89%) of the 528 imported malaria cases in the Kingdom of Bahrain were among nationals of India and Pakistan.¹⁶

It is well documented that mostly Indo-Gangetic plains, Northern hilly states, Northwestern and Southern India have < 10% *P. falciparum*, and the rest are *P. vivax* infections,¹⁷ whereas, in African countries, *P. falciparum* is predominant.⁶ In the present study, *P. vivax* was more commonly isolated in patients from India, Nepal, and Pakistan. On the other hand, *P. falciparum* was more commonly found among patients from Sudan. These findings are consistent with previous findings of research from neighboring Gulf countries.^{11-13,18,19}

In the present study, our data clearly indicate that imported malaria in Qatar has constantly increased from 2008 to 2013 and those most affected were adult male migrants from endemic countries such as India, Nepal, Pakistan, and Sudan. The increase in the total number of reported imported malaria cases between the 2008 and 2015 could be explained by the increased influx of foreign workers from malaria-endemic countries. In 2015, WHO's theme for World Malaria Day was "Invest in the Future: Defeat Malaria", which highlights the advances made in preventing, controlling, and eliminating malaria globally. Consequently, to reduce the importation of malaria cases into the State of Qatar, the

Ministry of Public Health (MoPH) held a public health awareness campaign targeting all travelers to malaria-endemic countries. Moreover, the ministry provides free malaria prophylaxis in travel clinics, which could explain the decline of malaria incidence during 2014-2015 in Qatar.

Imported malaria in Qatar has witnessed an increase during the past seven years, despite a long period of constant reduction; where the people most affected were adult male migrants from endemic countries. Additionally, challenges as a weak malaria surveillance system, lack of malaria awareness among health professionals as well as travelers, and a lack of cooperation among stakeholders must be mitigated to prevent malaria reintroduction in the country. With infrastructure expansions and new development in Qatar as the

country prepares to host the FIFA World Cup soccer tournament in 2022, it is expected that there will be a large influx of tourists, foreign workers, and those visiting friends and relatives. Therefore, the incidence of cases and the risk of malaria reintroduction are also likely to increase. Thus, an enhanced and robust surveillance program should be implemented to reduce imported malaria cases in the State of Qatar.

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