

Epidemiological pattern of imported malaria in Jordan from 2007 to 2011

Jamain, H.M.¹, Abu Shaqra, Q.A.^{1*} and Kanani, K.A.²

¹Department of Allied Medical Science, Al Zarqa University College, Al Balqa Applied University- Jordan

²Department of Parasitic and Zoonotic Diseases, Ministry of Health, Amman, Jordan

*Corresponding author e-mail: qabushaqra@hotmail.com

Received 1 June 2013; received in revised form 4 July 2013; accepted 6 July 2013

Abstract. Imported malaria is of major health concern to countries considered as free from this infection and Jordan is no exception. The aim of this study was to highlight various epidemiological aspects of imported malaria into Jordan over a period of five years. Information pertinent to all malaria cases registered in the Ministry of Health (Jordan) from January 2007 to November 2011 was retrieved from the database of the Department of Parasitic and Zoonotic Diseases. Data was grouped according to age, gender, country of acquisition and etiologic agents. During the study period, a total of 304 malaria cases were registered, 192 cases among Jordanians returning home and the remaining were detected among foreign nationals who arrived in the country for work or tourism. The majority of infections were due to *Plasmodium falciparum* (199 cases) followed by *Plasmodium vivax* (93) and then *Plasmodium malariae* (8). Mixed infection was detected in just 4 cases. The origin of these imported cases was in a descending order; Eritrea, Côte d'Ivoire, India, Sudan, Liberia and Pakistan. These countries contributed to 86.5% of cases while the remaining were acquired from other areas. It is believed that most Jordanians with imported malaria were military personnel who participated in Peace Keeping Forces with the United Nations. It is concluded that with the exception of imported cases reported herein, Jordan remains a malaria free country. Continuous vigilance by health authorities is needed to avoid reintroduction of the disease into the kingdom.

INTRODUCTION

Malaria is a communicable disease transmitted to humans through the bite of a female *Anopheles* mosquito. The infection is currently endemic in over 106 tropical countries in Sub-Saharan Africa, the South-West Pacific, South-East Asia and the rainforests of South America (World Malaria Report, 2011). According to this report, the mortality rate as a result of malaria infection has fallen by more than 25% globally since 2000. However, the infection is still one of the most important public health problems with more than 200 million cases and 655,000 deaths every year.

Although many countries of the world have been declared malaria free, it is

estimated that the total number of travellers that may acquire the infection from these endemic areas may be as high as 30,000 individuals per annum (Baas *et al.*, 2006). When these individuals return home, they bring along with them the infection. This type of infection dissemination in addition to infections introduced by immigrants or visitors to a specific country is called imported malaria. This phenomenon is of concern to health authorities' world wide and has been the subject of intensive research during the last decade (Centres for Disease Control and Prevention, 2006; Behrens *et al.*, 2008; Szilagyiova *et al.*, 2012).

Due to strict malaria surveillance programme and the effective control measures imposed by the Jordanian health

authority, the country was declared as malaria free since 1972 (De Zulueta & Muir, 1972). This infection is reportable in Jordan and because of its high risk, a special department for the follow up of all issues related to malaria was established by the Ministry of Health. Meneizel *et al.* (2009) conducted an epidemiological review of all malaria cases registered in Jordan from January 2000 to December 2005 and concluded that no single case was acquired in the country; all were imported. Abu Rumman *et al.* (2008) indicated that troops from Jordan serving in Peace Keeping Forces were usually given chemoprophylaxis in addition to preventive control instructions against malaria to minimize chances of acquiring the infection during their abroad service. Despite these precautions, the same authors indicated that many soldiers acquired the infection.

It is clear that travellers and personnel's serving abroad should be considered a potential source to re-introduce the infection into Jordan. This threat is of prime concern since malaria vectors continue to survive in the kingdom (Amr *et al.*, 1997); any relaxation in the implementation of the preventive measures currently in place would result in reintroduction of malaria into Jordan. Therefore, timely reports are needed to focus on the on going status of the infection in the country. This communication reports on the epidemiology of malaria detected in Jordan from January 2007 till December 2011 with special emphasis on countries where the infection was imported and the underlying etiologic agents.

MATERIALS AND METHODS

All activities related to the diagnoses of malaria cases, their treatment and the implementation of malaria control strategies in the Kingdom of Jordan are the responsibility of the Department of Parasitic and Zoonotic Diseases (PZD). Surveillance programmes in the country for the detection of new malaria cases particularly at border entry stations to the country are carried out

by trained technicians affiliated to this division. Persons arriving to Jordan from countries labelled by the WHO as high risk for malaria infection are usually screened for the presence of *Plasmodium* by microscopy using thick and thin blood smear stained with either Giemsa or Wright stain. Information regarding age, gender, the endemic area they arrived from, and their residency address were collected from each individual at the port of entry. Therefore, epidemiological data related to the occurrence of malaria infection in Jordan can best be obtained from the department of PZD. In this investigation, all cases of malaria registered in Jordan from January 2007 to November 2011 were retrieved from the database of PZD and grouped according to age, gender, and country of acquisition.

RESULTS

From January 2007 to December 2011, a total of 304 cases of malaria were reported to the Department of Parasitic and Zoonotic Diseases, Ministry of Health in Jordan and all cases were detected among arrival into the country from endemic regions of the world. The highest number of cases was reported in 2007 (84) while the lowest was reported in 2008 (49). There were 53, 60 and 58 cases in the years 2009, 2010 and 2011, respectively. It is worth mentioning that all registered cases were imported and none was acquired locally. It is clear from table 1 that malaria was more prevalent in males than females with the infection rate being the highest in the age group between 25–34 years. The same table demonstrates that only 6 cases were detected among children.

It is important to note that 192 cases were reported among Jordanians whereas; the remaining 112 cases were detected among visitors to the kingdom from other countries. There were 40, 22, 11, 11 and 28 imported cases from India, Sudan, Pakistan, and other countries, respectively. It was of interest to determine the countries from which malaria patients have come from and this was established in table 2. In brief, arrivals from

Table 1. Malaria cases by age group and gender from January 2007 to December 2011

Age group	0-14	15-24	25-34	35-44	45 plus	Total
Male	5	27	142	73	34	281
Female	1	0	7	10	5	23
Total	6	27	149	83	39	304

Table 2. Malaria cases by source and type of etiologic agent from January 2007 to December 2011

	<i>P. vivax</i>	<i>P. falciparum</i>	<i>P. malariae</i>	Mixed	Total
Eritrea	68	0	0	0	68
Côte d'Ivoire	28	31	4	2	65
India	45	7	0	1	53
Sudan	8	31	0	1	40
Liberia	12	4	3	0	19
Pakistan	18	0	0	0	18
Yemen	2	11	1	0	14
Haiti	11	0	0	0	11
Others	7	9	0	0	16
Total	199	93	8	4	304

Eritrea and Côte d'Ivoire in addition to India were found to constitute the vast majority of cases (186) that were registered during the study period. The least occurrence of infection was detected among arrivals from Haiti and Yemen.

Table 2 also reports on the causative agent of the 304 malaria cases reported herein, the etiologic agents in 199 and 93 of cases were *P. vivax* and *P. falciparum*, respectively. Mixed infection was reported only in 4 individuals, while *P. malariae* was responsible for 8 cases. It is worth noting that highest number of *P. vivax* cases were imported from Eritrea while most *P. falciparum* cases were from Côte d'Ivoire and Sudan.

DISCUSSION

A total of at least 100 countries located in 3 different continents: Africa, Asia and South America are officially considered malarious (World Malaria Report, 2011). Acquiring malaria abroad depends upon several factors among which the extent of infection in the

visited country and traveller's contact with infected mosquitoes are important. This communication has demonstrated that with the exception of Haiti, all malaria cases reported in Jordan were acquired from African and Asian countries. Meneizel *et al.* (2009) have studied the epidemiology of malaria in Jordan between 2000 and 2005 and found that all cases were imported. They also established that the majority of cases were imported from East Africa (Sudan and Eritrea) and South East Asia (Timor); in agreement with our findings.

The only difference between our study and that of Meneizel *et al.* (2009) was the number of cases reported; it was 808 in their work while in this investigation malaria detection rate was 304 cases over a period of five years. This observation means that approximately 45.3% reduction in the occurrence of malaria was noted in recent years as compared to those registered in the first five years of the new millennium. This reduction could be attributed to the use of chemoprophylaxis and control measures against malaria by Jordanians serving abroad. However, the use of Mefloquine plus

adequate preventive control measures against mosquito bites was not found to be 100% effective to prevent malaria infection among soldiers serving in countries with high prevalence rate of malaria; they merely reduced the incidence of the disease (Abu Rumman *et al.*, 2008).

The phenomenon of imported malaria is not confined to a specific country. Brustenga *et al.* (2006) showed that most malaria cases reported in Spain between 2002 and 2004 were imported from the African continent. In Northern Ireland, Ong & Smyth (2006) indicated that most cases reported in their country between the years 1998 and 2003 were associated with travellers to West Africa. Although malaria transmission was successfully interrupted in the United States a long time ago, it was reported that travellers to malarious areas in 2004 imported 1324 cases, again most of these cases occurred in individuals who travelled to Africa (CDC, 2006). Non-Jordanian nationals who arrived to Jordan with malaria infection constituted 36.8% of the reported cases. The majority of these individuals were either Indians or Sudanese. This observation is not surprising as these two countries are considered malarious. In 2009, India reported that there were over 1.5 million of confirmed cases annually (Anon, 2009) and in Sudan, it was estimated that as high as 9 million episodes occurred in the year 2002 (Abdalla *et al.*, 2007).

Prevalence of malaria in males and females varied extensively; it was found that 92.4% of cases were detected among males while the remaining percentage was among females. Gender variation in the occurrence of malaria reported in this study should not be compared with similar data released from endemic areas as our cases were imported and travellers who arrived to the kingdom happened to be predominantly males. The same is applicable to the cases of malaria detected in children. However, the few cases detected among children were consistent with those published by others. Surveillance carried out in the Netherlands between 1996 and 2006 detected 23 cases of malaria among children of immigrant's (Driessen *et al.*, 2008). In this context, it is unlucky that it was

not possible to ascertain the nationality of the infected children as records of the Department of PZD did not provide information regarding this subject.

As shown in table 1, malaria was prevalent in the age group of 25 to 34 years followed by the 35 to 44 years age group. This is probably explained by the predominance of these age groups travelling or arriving in Jordan. Because most of the reported cases were acquired from countries where Peace Keeping Forces are deployed, it was assumed that most of the cases reported in Jordan were discovered in personnel affiliated to the Jordanian armed forces who returned home after completing their services in areas where malaria is highly prevalent. Unfortunately this assumption could not be verified from the records of the Ministry of Health; nevertheless, the findings of Meneizel *et al.* (2009) in addition to those of Abu Rumman *et al.* (2008) might provide a solid ground for our assumption.

The etiologic agent of each infected case was very much related to the country from which the patient has arrived from. All cases imported from Eritrea were due to *P. vivax* infection and this is in agreement with the report of Kopel *et al.* (2010) who investigated a group of Eritrean refugees and found that all were infected with *P. vivax*. On the other hand, cases from Côte d'Ivoire were mainly attributed to infections caused by *P. falciparum* and to a lesser extent by *P. vivax*. These observations are again consistent with reports released describing the etiologic agents responsible for the infection in various African countries (Autino *et al.*, 2012). The predominant causative agent for the cases acquired in Timor, Pakistan and Indian was *P. vivax* species. This result was anticipated as many studies have reiterated that this particular species of malaria is dominant in these countries (Al-Tawfiq, 2006; Kumar *et al.*, 2007; Stark & Schöneberg, 2012).

This communication has demonstrated that Jordan remains malaria free country. All cases reported during the study period were imported from countries where this infection is still highly prevalent. The majority of cases registered among Jordanians were believed to be in military troops serving in Peace

Keeping Forces and this observation demands prompt attention by the health directorate in the Jordanian Armed Forces to act swiftly by mandating the use of chemoprophylaxis and instructing soldiers about precautionary measures before their deployment.

REFERENCES

- Abdalla, S.I., Malik, E.M. & Ali, K.M. (2007). The burden of malaria in Sudan: incidence, mortality and disability-adjusted life- years. *Malaria Journal* **6**: 97. doi:10.1186/1475-2875-6-97.
- Abu Rumman, S., Wardat, Y., Abu Rumman, M., Arabiat, M. & Aljar, M. (2008). Malaria incidence among a group of Jordanian military troops in Sierra Leone in 2000. *Journal Royal Medical Services* **15**(2): 38-40.
- Al-Tawfiq, J.A. (2006). Epidemiology of travel- related malaria in a non-malarious area in Saudi Arabia. *Saudi Medical Journal* **27**(1): 86-89.
- Amr, Z.S., Ajzju- Ali li, Y. & Arbaji, A. (1997). Larval mosquitoes collected from northern Jordan and the Jordan valley. *Journal of the American Mosquito Control Association* **13**(4): 375-378.
- Anon. (2009). Guidelines for the diagnosis and treatment of malaria in India. National Institute of Malaria Research. Sector 8 Dwarka, New Delhi.
- Autino, B., Noris, A., Russo, R. & Castelli, F. (2012). Epidemiology of malaria in endemic areas. *Mediterranean Journal of Hematology and Infectious Diseases* **4**: OpenJournal System.
- Baas, M.C., Wetsteyn, J.C.F. M. & Van Gool, T. (2006). Patterns of imported malaria at the Academic Medical Center, Amsterdam. *The Netherlands Journal of Travel Medicine* **13**(1): 2-7.
- Behrens, R.H., Carroll, B., Smith, V. & Alexander, N. (2008). Declining incidence of malaria imported into the UK from West Africa. *Malaria Journal* **7**: 235. doi: 10.1186/1475-2875-7-235.
- Brustenqa, C.I. (2006). Malaria imported by immigrants. *Anales del Sistema Sanitario de Navarra* **29** (suppl 1): 121-5.
- Department of Health and Human Services, Centres for Disease Control and Prevention. (2006) Malaria and Travelers.
- De Zulueta, J. & Muir, D.A. (1972). Malaria eradication in the Near East. *Transactions of the Royal Society of Tropical Medicine and Hygiene* **66**: 679-696.
- Driessen, G.J., Pereira, R.R., Brabin, B.J. & Hartwig, N.G. (2007). Imported malaria in children: a national surveillance in the Netherlands and a review of European studies. *European Journal of Public Health* **18**(2): 184-188.
- Kopel, E., Schwartz, E., Amitai, Z. & Volovik, I. (2010). Relapsing Vivax malaria cluster in Eritrean refugees, Israel, June 2010. *Eurosurveillance* **15**(26): 1-3.
- Kumar, A., Valecha, N., Jain, T. & Dash, A.P. (2007). Burden of malaria in India: Retrospective and prospective view. *American Journal of Tropical Medicine and Hygiene* **77**(6): 69-78.
- Meneizel, S., Rabadi, K., Muhareg, H. & Kawar. (2009). Epidemiology of imported malaria cases in Jordan between 2000 and 2005. *Journal Royal Medical Services* **16**(3): 10-15.
- Ong, G.M. & Smyth, B. (2006). Imported malaria to Northern Ireland: improving surveillance for better intervention. *Ulster Medical Journal* **75**(2): 129-35.
- Stark, K. & Schöneberg, I. (2012). Increase in malaria cases imported from Pakistan to Germany. *Eurosurveillance* **17**(47): 1-2.
- Szilagyiova, M., Novakova, E., Svihra, J. & Hudeckova, H. (2012). Costs analysis of the treatment of imported malaria. *Malaria Journal* **11**: 1. doi: 10.1186/1475-2875-11-1
- World Health Organization (2010). International Travel and Health: Situation as on 1 January 2010. *World Health Organization, Geneva*
- World Malaria Report (2011). ISBN: 97892411564403