



EPIDEMIOLOGICAL SURVEILLANCE REPORT

Malaria in Greece, 2016, up to 03/08/2016

Introduction

Malaria is a parasitic infection, transmitted through the bite of the infected female *Anopheles* mosquito. Five species of *Plasmodium* cause disease to humans: *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium ovale*, *Plasmodium malariae* and *Plasmodium knowlesi*. The most common symptoms of malaria (chills, high fever, sweating, malaise, headache and muscle aches) manifest usually 1-4 weeks after infection with the parasite, while relapses of the disease are usually observed in short intervals but up to five -and in extreme cases even up to eight- years after *P. vivax* infections. A number of effective anti-malarial drugs are available to treat the infection; starting the treatment promptly is essential in avoiding complications and interrupting the transmission of the disease in the community.

Malaria is currently endemic -with ongoing transmission- in 95 countries around the world (WHO, World Malaria Report, 2015), mainly in sub-Saharan Africa, Asia and Latin America. Greece was declared malaria-free in 1974, after an intense malaria eradication program (1946-1960). Until 2008, approximately 20-50 cases were reported annually to the Hellenic Center for Disease Control & Prevention (HCDCP), the majority of which were travel related. Until 2008, sporadic malaria cases without reported travel history were reported in 1991, 1999 and 2000.

After 2009, *P.vivax* malaria re-emerged in areas of the country that were hotspots of malaria before its eradication, both as sporadic introduced cases and as clusters, in persons without travel history to a malaria endemic country. A number of Public Health (PH) measures were implemented to avoid re-establishment of the disease in the country.

Malaria surveillance

Data are derived from the reports of laboratory-confirmed malaria cases to the HCDCP and the HCDCP' enhanced surveillance systems. The Department of Epidemiological Surveillance and Intervention undertakes a verification procedure through communication with the treating physicians, the hospital and the reference laboratory for malaria. Case, focus and environmental investigation are undertaken by the staff of the Department of Epidemiological Surveillance and Intervention, with the collaboration of local public health authorities, for every locally acquired malaria case throughout Greece, as well as for some imported malaria cases in high-risk, receptive areas (i.e., areas with confirmed or suspected circulation of the competent vector - *Anopheles* mosquitoes).

Malaria surveillance data, 2009 – 2015

The number of malaria cases in Greece reported to the HCDCP by year of symptom onset and epidemiological classification (imported/ locally-acquired) is presented in Table 1.

Table 1: Reported malaria cases by year of symptom onset¹ (for imported cases) or infection (for locally-acquired cases) and by epidemiological classification (imported/ locally-acquired), Greece, 2009 - 2015.

Year of symptom onset	Case classification		Total
	Imported cases	Locally-acquired cases ²	
2009	44	7	51
2010	40	4	44
2011	54	42	96
2012	73	20	93
2013	22	3	25
2014	38	0	38
2015	79	6	85

1. Cases with no information regarding the year of symptom onset were classified according to the year of hospitalization or notification to the HCDCP.
2. Known *P.vivax* relapses and locally-acquired *P.malariae* cases attributed to previous transmission periods (two cases in 2012) are not included in the Table.

It should be noted that the aforementioned case classification is based on epidemiological criteria (e.g. history of travel within the last 3 years to a malaria endemic country). However, recent *Plasmodium* genotyping results suggest that a number of cases previously classified as “imported” are actually locally acquired (e.g. some of the malaria cases in immigrants from malaria endemic countries residing in the Municipalities of Evrotas, Lakonia and Sofades, Karditsa, in transmission periods 2011-2012).

Malaria surveillance data, 2016, up to 03/08/2016

In 2016, up to 03/08/2016, a total of 55 laboratory diagnosed cases of malaria were reported to the HCDCP; 53 cases were classified as imported (42 immigrants and 11 travellers) and two (2) *P.vivax* malaria cases were classified as introduced locally acquired. As regards possible places of exposure for these two cases, case and focus investigation findings suggest the following: one case is considered to be exposed in the Municipal Unit of Larissos, Municipality of West Ahaia, Regional Unit (RU) of Ahaia, West Greece Region (with onset of symptoms in the week 26/2016 (27/06-03/07/2016)), and one case is considered to be exposed in the Municipal Unit of Vouprasia, Municipality of Andravida-Kyllini, Regional Unit (RU) of Ileia, West Greece Region (with onset of symptoms in the week 29/2016 (18-24/07/2016)).

Table 2 shows the reported malaria cases by epidemiological classification (imported/locally acquired), individual status (immigrants/returning traveller) and *Plasmodium* species.

Table 2. Malaria cases by epidemiological classification, status and *Plasmodium* species, Greece, 2016, up to 03/08/2016 (n=55)

Epidemiological classification and status		<i>Plasmodium</i> species				Total
		<i>P. vivax</i>	<i>P. falciparum</i>	<i>P. falciparum</i> + <i>P. ovale</i>	Unspecified	
Imported cases	Immigrants	35	6	0	1	42
	Travelers	1	8	1	1	11
Locally acquired cases		2	0	0	0	2
Total		38	14	1	2	55

[Table 3](#) presents the reported malaria cases in Greece by epidemiological classification (imported/locally acquired), status (immigrants/returning traveller) and place of residence (for the imported cases) or exposure (for the locally acquired cases).

Table 3. Classification of reported malaria cases by Regional Unit of residence/exposure, case classification and patient status, Greece, 2016, up to 03/08/2016 (n=55)

Regional Unit of residence/infection	Case classification			
	Imported cases			Locally acquired cases
	Immigrants from malaria endemic countries	Travelers to malaria endemic countries	Total	
East Attica	3	0	3	0
West Attica	2	0	2	0
Central Section of Athens	7	2	9	0
North Section of Athens	1	2	3	0
South Section of Athens	0	1	1	0
Ahaia	1	0	1	1
Viotia	2	0	2	0
Ileia	2	0	2	1
Lakonia	9	0	9	0
Larisa	1	1	2	0
Lasithi	4	0	4	0
Lesvos	7	0	7	0
Messinia	0	1	1	0
Naxos	0	1	1	0
Xanthi	0	1	1	0
Piraeus	1	0	1	0

Rodos	0	2	2	0
Samos	2	0	2	0
Total	42	11	53	2

HCDCP activities for the management of malaria, 2011-2016

During spring 2012 the HCDCP developed an Action Plan for the Management of Malaria 2012-2015, and during summer 2015 the “Action Plan for the Management of Malaria” of the Ministry of Health was published. These include a risk assessment scheme for the re-emergence of malaria in the different areas of Greece, where all areas (Regions, Municipalities) in Greece were assigned a Risk Level from 0-3, taking into consideration the malaria cases reported in the previous years (since 2009), the size and place of origin of migrant population in the area and the ecological parameters.

Activities for the management of malaria implemented by HCDCP include:

I. Enhanced malaria surveillance activities

- **Case investigation:** HCDCP investigates all notified malaria cases in order to classify them as imported or locally acquired. For locally-acquired cases or imported cases in receptive areas, an in-depth interview with the patient is conducted, in order to identify the suspected place of exposure or/and the risk for further local transmission.
- **Immediate communication to stakeholders and health professionals** at national and local level, after the reporting of each locally-acquired malaria case to the HCDCP:
 - i. Hierarchy of the Ministry of Health (MoH),
 - ii. Regional public health authorities,
 - iii. Municipalities,
 - iv. MoH Committee for the Prevention and Management of Tropical Diseases,
 - v. Working Group for the designation of areas affected from vector-borne diseases,
 - vi. National Centre for Blood Donation, responsible for the relevant blood safety measures,
 - vii. physicians practicing in the affected area, to raise their awareness for investigating suspect cases.
- **Focus investigation – re-active case detection in the focus of the diagnosed case:** HCDCP investigation teams are deployed after the notification of each locally acquired case to perform a “focus investigation”, in an area indicated by the epidemiological, entomological and environmental investigation. In this activity, all immigrants from malaria endemic countries in the focus are tested for malaria (RDT, microscopy and PCR), while individuals from non-endemic countries are screened for malaria compatible symptoms and tested for malaria accordingly. Fever screening is repeated on a regular basis for a month after the initial investigation.
In 2016 HCDCP staff -in collaboration with local public health authorities- coordinated and performed focus investigation for the two locally acquired cases, including raising awareness of the physicians working in the respective areas and the local communities.
- **Environmental and vector investigation** is performed in the area after the detection of each locally acquired malaria case (or imported case in a receptive area), in order to identify *Anopheles* breeding sites and other risk factors for local transmission.

- **Proactive malaria case detection in Evrotas Municipality, Lakonia:** The HCDCP, in collaboration with the University of Thessaly, the Region of Peloponnese and the Municipality of Evrotas deployed -from 2011 and since then during each transmission period (April to December)- a field team in the area for the active detection of malaria cases. Since 2015 and in 2016, the field team with staff from the University of Thessaly and coordination from the HCDCP, with the financial support of the Region of Peloponnese, continues the active malaria case detection programme, undertaking also the focus investigation of all recorded malaria cases. A significant number of immigrants from malaria endemic countries (Pakistan mainly) live and seasonally work in Evrotas. During the field visits, health promotion information is provided for protection against mosquitoes and fever screening and/or testing for malaria is performed regularly. In 2016, fever screening visits are performed every 10-15 days in immigrant and Roma residences.
 - **Enhancing laboratory diagnosis of malaria:** Since 2012, HCDCP has distributed Rapid Diagnostic Tests (RDTs) for malaria to Hospitals and Health Centers in areas with recently recorded local malaria transmission, areas with large populations of immigrants from endemic countries (large urban centers, points of entry for immigrants) aiming at prompt diagnosis and treatment of malaria cases. RDTs have contributed significantly to the early detection of malaria cases in our experience and have been proven a valuable field tool. Furthermore, HCDCP recommends sending the samples from any laboratory to the reference laboratory, for confirmation and/ or further genotyping. In 2016, HCDCP organizes RDTs distribution to immigrants' points of care and nearby Health Units.
- II. Administration of antimalarial drugs to immigrants from malaria endemic countries:** In 2013 -2015, following the proposal of the HCDCP Working Group on Vector-borne Diseases and the approval of the Committee for the Prevention and Management of Tropical Diseases of the Ministry of Health, the field team in Lakonia delivered one course of antimalarials for *P.vivax* infection (Chloroquine + Primaquine) to all immigrants from malaria endemic countries who lived in the Municipality of Evrotas. The antimalarials were administered using directly observed treatment (DOT) protocol with the informed consent of the participating immigrants and following testing of G6PD levels. The antimalarial course targeted *P.vivax* hypnozoites in order to reduce the reservoir and interrupt transmission of the disease.
- III. Case management - Standardization of the malaria treatment in Greece,** according to treatment guidelines developed by the HCDCP with the input of experts in infectious diseases. HCDCP maintains a small stockpile of specific anti-malarial medicines for timely distribution to Health Units for emergency treating of patients.
- IV. Increase awareness amongst health professionals** for the diagnosis and management of malaria. HCDCP staff delivers presentations and organizes seminars for health professionals in Health Centers/Hospitals in areas with recently recorded locally acquired cases. Informative letters are also sent to all hospitals, in an annual basis and urgently, in areas with locally acquired cases.
- V. Communication to the public** on malaria and personal protection measures against mosquitoes:
- Educational material on malaria and protective measures against mosquitoes is available on the HCDCP website (www.keelpno.gr) and leaflets are available for each use.

- After the notification of the locally acquired cases in 2016, HCDCP field team informed the local population, door-to-door, and raised awareness about malaria and the necessary protective measures against mosquitoes during the focus investigations.

VI. Coordination of an intersectoral Working Group (WG) on the designation of affected areas by vector borne diseases. This WG considers all available epidemiological data and decides on the characterization of malaria affected areas in Greece, which is then used by the National Centre for Blood Donation to issue guidance on blood safety. The list of affected municipalities is published on our website (www.keelpno.gr) and updated regularly according to reported cases.

VII. Vector control activities - Entomological surveillance:

- **Raising awareness and guidance to Regional Authorities:** HCDCP communicates regularly with all Regional Authorities in Greece recommending the timely planning, organization and implementation of integrated vector control programmes, identifying the high risk areas. Detailed technical guidance is timely communicated by the HCDCP to the Regional administrations all over the country, in order to assist them to implement on time the calls for tender for integrated vector control programs. In 2016, further awareness was raised regarding risk assessment and intensifying mosquito control programs accordingly around the immigrants' points of care.
- **Distribution and placement of Long Lasting Insecticide-treated Nets (LLINs):** According to WHO and ECDC guidance, HCDCP distributes (since 2013, in each transmission period) LLINs to immigrants, along with mosquito repellent coils, in the Municipality of Evrotas, Lakonia, after obtaining a special permit from the Ministry of Agriculture.
- **Participation in the implementation of indoor residual spraying (IRS):** The ACD field team indicates migrant residencies in Evrotas. HCDCP continues to recommend this vector control method in this area.
- **Entomological surveillance:** The HCDCP, in collaboration with the Department of Parasitology, Entomology and Tropical Diseases of the National School of Public Health (NSPH), the Benaki Phytopathological Institute, the MALWEST program, Universities, Regions, local authorities and subcontractors of the local mosquito control programmes, implemented, participated or coordinated -from 2010 to 2015- active vector surveillance programme. For the 2016 transmission period, vector surveillance is conducted in limited areas, from NSPH, with the voluntary participation of Regions, local authorities and the subcontractors. HCDCP recommended to local authorities to perform vector surveillance, especially in areas concentrating risk factors for local malaria transmission (e.g. rural areas with large populations of immigrants from malaria endemic countries) and tries to collect vector surveillance data from these areas, as well as from areas with recent local transmission.
- **Risk assessment:** HCDCP performs risk assessment for malaria local transmission, especially in areas around immigrants' points of care, evaluating all local risk factors (vector, environmental and demographic data, e.g. populations from endemic countries). HCDCP, in collaboration with the local authorities, has performed field visits in immigrants' points of care in Central Macedonia Region, in order to record the nearby large mosquito breeding sites, collect more data and further assess the risk.

- **Communication with international public health stakeholders:** The HCDCP communicates frequently for exchange of knowhow and information on malaria cases and activities with the ECDC and WHO, as well as with a number of European and international agencies and networks.

Conclusions

As indicated by the above surveillance data, and despite Greece being malaria-free since 1974, the risk of re-establishment of the disease in specific areas of the country exists, especially where the presence of adequate numbers of *Anopheles* mosquitoes (the competent vector of the disease) is combined with the presence of malaria patients coming from endemic countries.

Following a peak of local malaria transmission in 2011, the number of recorded locally acquired malaria cases declined steadily in the consecutive years becoming zero in 2014. This coincided with a number of intense and costly public health interventions implemented since 2011, with the collaboration of various stakeholders at the national, regional and local level, which have contributed to the successful prevention of the re-establishment of malaria in Greece.

In 2015 six introduced locally acquired malaria cases were reported in Greece, in new and old -vulnerable and receptive- areas, and in 2016, up to 03/08/2016, two introduced locally acquired cases were recorded in new areas. The appearance of such sporadic introduced malaria cases has been recorded in the previous years and is partially expected, with the recent significant increase of the migrant population from endemic countries hosted in the country.

Early detection, appropriate investigation and treatment of malaria cases combined with **effective vector control** (larviciding and IRS) represent the main components of the public health strategy to fight the re-introduction of *P. vivax* in Greece and prevent its re-establishment in high risk areas of the country.

However, all the above need also the maintenance of health and public health services, physician awareness, and systematic implementation of integrated vector control programmes (including vector surveillance). In addition, free access to health services for immigrants (including undocumented ones) for timely diagnosis and treatment of malaria, communication with the immigrants and achieving a minimum standard of their living conditions and well-being, constitute further determinant factors for avoiding further transmission in the local community.

Advice for travelers in Greece:

The HCDCP, based on the surveillance data available until now and the implemented prevention measures in the areas where locally-acquired *P. vivax* malaria cases have been reported, maintains that **the risk to travelers for malaria infection in Greece is very low. Chemoprophylaxis for malaria is not recommended** for visitors to areas where locally acquired malaria cases have occurred until today. Personal protective measures against mosquitoes are strongly encouraged.