



EPIDEMIOLOGICAL SURVEILLANCE REPORT

Malaria in Greece, 2014

Introduction

Malaria is a parasitic infection, transmitted through the bite of the infected female *Anopheles* mosquito. Five types of plasmodia 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 97 countries around the world (WHO, World Malaria Report, 2014), mainly in sub-Saharan Africa and Asia. 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 we have faced the risk of re-emergence of *P. vivax* malaria in some areas of the country, both as sporadic introduced cases and as clusters, in persons without travel history to a malaria endemic country.

Malaria surveillance

Data are derived from the reports of laboratory-confirmed malaria cases to the HCDCP. 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 and focus investigation is undertaken by the staff of the Department of Epidemiological Surveillance and Intervention for malaria cases without reported travel history and for all malaria cases in Risk Level 3 areas, i.e., areas with clusters of malaria cases (such as in the Municipality of Evrotas, Lakonia, where clusters of malaria cases were detected in 2011-2012 and in the Municipality of Sofades, Karditsa, where a cluster was detected in 2012).

Areas where sporadic malaria cases without travel history to a malaria endemic country are detected are immediately elevated to Risk Level 2 (according to the national risk assessment scheme) and are closely monitored for the following years.

Malaria surveillance data, 2009 – 2013

The number of malaria cases reported to the HCDCP in 2009-2013 by year of symptom onset or infection and by 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 - 2013. Page | 2

Year of symptom onset / infection	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

1. Cases with no information regarding the year of symptom onset were classified according to the year of hospitalization or notification.
2. Known recorded 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., the history of recent 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. immigrants from malaria endemic countries residing in the Municipalities of Evrotas, Lakonia and Sofades, Karditsa, in transmission periods 2011-2012).

Malaria surveillance data, 2014

In 2014, a total of 38 imported laboratory confirmed cases of malaria were reported to the HCDCP (12 cases in immigrants from malaria endemic countries and 26 in returning travellers). Of the 37 imported cases with known *Plasmodium species*, 31 cases were confirmed as *P.falciparum* infections (7 immigrants from malaria endemic countries and 24 in returning travellers) and 6 cases were confirmed as *P.vivax* infections (5 immigrants from malaria endemic countries and 1 in returning traveller). In 2014 no locally acquired case was recorded in Greece.

The classification of all the malaria cases reported to the HCDCP in 2014 by place of residence/exposure and status of the patient (immigrants/traveller) is presented in [Table 2](#).

Table 2. Classification of imported reported malaria cases by Regional Unit of residence and patient status, Greece, 2014 (n=38)

Regional Unit of residence	Patient status		Total imported
	Immigrants from malaria endemic countries	Travelers to malaria endemic countries	
Central Section of Athens	6	4	10
North Section of Athens	0	4	4
South Section of Athens	0	1	1
West Attica	1	1	2
East Attica	0	2	2
Arkadia	1	0	1
Achaia	1	1	2
Evros	0	1	1
Heraklion	1	1	2
Kalymnos	0	2	2
Corinth	1	0	1
Lakonia	0	1	1
Lasithi	1	1	2
Lesvos	0	1	1
Lemnos	0	1	1
Messinea	0	2	2
Piraeus	0	2	2
Pieria	0	1	1
Total	12	26	38

HCDCP activities for the management of malaria, 2014

During spring 2012 the HCDCP developed an Action Plan for the Management of Malaria 2012-2015, which included a risk assessment scheme for the re-emergence of malaria in the different areas of Greece. Based on this risk assessment, all areas (Regions, Municipalities) in Greece were assigned a Risk Level from 0-3, taking into consideration the malaria cases reported in the last six years, the size and place of origin of migrant population in the area and the ecological parameters in each area.

Activities to control malaria are implemented by HCDCP, in collaboration with a national project "*Integrated Surveillance and control programme for West Nile Virus and malaria in Greece*" (www.malwest.gr) coordinated by the University of Thessaly, and 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 place of exposure 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,
 - ii. Regional public health authorities,
 - iii. Working Group for the designation of VBD affected areas,
 - iv. National Centre for Blood Donation, responsible for the relevant blood safety measures,
 - v. Physicians practicing in the affected area, to raise their awareness for investigating suspect cases.
- **Focus investigation – reactive case detection in the focus of the diagnosed case:** HCDCP investigation teams are deployed after the detection 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 weekly basis for a month after the initial investigation.

In 2014 HCDCP staff -in collaboration with local public health authorities- performed focus investigation for three imported cases in receptive (rural) areas, as well as raising awareness of the physicians working in these areas.

- **Environmental and vector investigation** is performed in the area after the detection of each locally acquired malaria case, 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 national project "*Integrated Surveillance and control programme for West Nile Virus and malaria in Greece*", deployed -for the third consecutive transmission period- a field team in the area of Evrotas, Lakonia from April to December 2014. A significant number of immigrants from malaria endemic countries (Pakistan and Afghanistan, etc) live and work in Evrotas. From May to November 2014, the number of immigrants from endemic countries recorded in 14 villages ranged between 450 and 670 persons. A registry of all residences and residents has been in place since 2012. During the field visits, health promotion information was provided for protection against mosquitoes and fever screening

and/or testing for malaria was performed regularly. In 2014 fever screening visits were performed on average every 7-10 days for the target population in the area (immigrant and Roma populations).

- **Proactive malaria case detection in Sofades Municipality, Karditsa:** The HCDCP, in collaboration with the national project “*Integrated Surveillance and control programme for West Nile Virus and malaria in Greece*”, deployed a field team in the area of Sofades Municipality, Karditsa from July to November 2014. A significant number of immigrants from malaria endemic countries live and work in this area during summer. From July to October 2014, the number of immigrants from endemic countries recorded in 5 villages ranged between 150 and 250. During the field visits, a registry of all residences and residents was created, health promotion information was provided for protection against mosquitoes and fever screening and/or testing for malaria was performed regularly. In 2014 fever screening visits were performed on average every 14 days for the target population in the area (immigrants from endemic countries).
 - **Malaria screening in immigrants from endemic countries** residing in an immigration detention center in Evros Regional Unit, in the area were two locally acquired cases were recorded in 2013.
 - **Enhancing laboratory diagnosis of malaria:** In 2014, HCDCP distributed Rapid Diagnostic Tests (RDTs) for malaria to hospitals and Health Centers in areas with recently recorded local malaria transmission and areas with large populations of immigrants from endemic countries (large urban centers, areas with immigration detention centers, irregular points of entry for undocumented immigrants) aiming at prompt diagnosis and treatment of malaria cases. Approximately 3,000 RDTs for malaria were distributed in 2014 in 106 Health Units. 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 and facilitates the samples to be sent from any laboratory to the reference laboratory, for confirmation and/ or further genotyping.
- II. Administration of antimalarial drugs to immigrants from malaria endemic countries:** In 2014, following the decision of the HCDCP Working Group on Vector-borne Diseases and the approval of the Committee for the Control of Tropical Diseases of the Ministry of Health, the field team in Lakonia delivered for the second transmission period one course of antimalarials for *P.vivax* infection (Chloroquine + Primaquine) to all immigrants from malaria endemic countries who lived in the Municipality of Evrotas. This therapeutic intervention was provided using Directly Observed Treatment (DOT) protocols 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. In 2014, DOT antimalarial therapy was administered to 232 persons in the area of Evrotas.
- III. Standardization of the malaria treatment in Greece,** according to treatment guidelines developed by the HCDCP with the input of experts in infectious diseases. In order to follow up the effectiveness of treatment, a specific protocol is also recommended to monitor patients during and after treatment completion. HCDCP have secured supply of specific anti-malarial medicines for timely distribution to Health Units and treating of patients.
- IV. Increase awareness amongst health professionals** for the diagnosis and management of malaria. In 2014, HCDCP staff delivered presentations and organized seminars for health professionals in 19 Health Centers/Hospitals in areas where locally acquired cases had occurred. Informative letters were also sent to all hospitals.

V. Communication to the public on malaria and personal protection measures against mosquitoes:

- HCDCP distributed in 2014 10,000 leaflets with educational material for the public on the precautions against mosquito bites in 12 Municipalities and 8 Regional Units where local malaria transmission was recorded in the previous years, in collaboration with local authorities. Educational material is available on the KEELPNO website (www.keelpno.gr).
- A video advertisement with information on protection measures against mosquito bites was disseminated during the summer months.
- HCDCP organized and conducted in 2014 public meetings in areas where local transmission was recorded in 2013, in collaboration with local public health authorities. More specifically, HCDCP performed in June 2014 five public meetings in the Municipality of Sofades, Karditsa and participated in May 2014 in a public meeting in the Municipality of Alexandroupolis, Evros.

VI. Coordination of an intersector 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 affected areas, 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. According to the experts in this WG, as of 30th January 2015, no Municipality in the country is considered affected by malaria.

VII. Vector control activities - Entomological surveillance:

- **Raising awareness about vector borne diseases 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 was 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.
- **Distribution and placement of Long Lasting Insecticide-treated Nets (LLINs) to immigrants:** According to WHO and ECDC guidance, HCDCP distributed LLINs to immigrants in Risk Level 3 areas, along with mosquito repellent coils:
 - i. in the Municipality of Evrotas, Lakonia, after obtaining a special permit from the Ministry of Agriculture, approximately 418 LLINs were distributed in immigrants, and
 - ii. in the Municipality of Sofades, Karditsa, LLINs were distributed in seven immigrants residencies.
- **Implementation of indoor residual spraying (IRS):** The HCDCP field team was responsible for the communication ahead of the IRS applications and for indicating immigrants' residencies in Evrotas Municipality. IRS in this area was conducted in 2014 by the Regional authority of Peloponnese.
- **Entomological surveillance:** The HCDCP, in collaboration with the Department of Parasitology, Entomology and Tropical Diseases of the National School of Public Health, the MALWEST project, local authorities and the subcontractors of the local mosquito control programs, implemented for the 2014 transmission period active entomological surveillance covering the majority of the country (59 adult mosquito traps were placed in 31 Regional Units, in 10 Regions, every 15 days, from June to October 2014). The entomological data were immediately communicated to all national, regional and local

stakeholders. According to these findings, the highest mosquito populations were observed throughout Greece during the beginning of August 2014.

- **Mapping of mosquito breeding sites in the affected area in the Municipality of Sofades, Karditsa**, in May 2014, in collaboration with the Benaki Phytopathological Institute.
- In the framework of the national project “*Integrated Surveillance and control programme for West Nile Virus and malaria in Greece*”, a number of entomological activities were also carried out in 2014:
 - i. testing of *Anopheles spp.* collected in Evrotas using molecular techniques for *Plasmodium* presence in the University of Crete,
 - ii. mosquito overwintering study,
 - iii. study on the comparison of effectiveness of various mosquito traps.
- iii. **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 recent 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, where the presence of adequate numbers of *Anopheles* mosquitoes (the competent vector of the disease) are combined with the presence of malaria patients coming from endemic countries.

After the recent peak of the local malaria transmission in 2011, the number of recorded locally acquired malaria cases kept declining in the consecutive years and zeroed in 2014. A number of intense and costly public health interventions were implemented, with the collaboration of various stakeholders at the national, regional and local level, which have contributed to the successful prevention of the re-emergence of malaria in Greece.

Other factors playing a role in the possible re-introduction of malaria in specific areas of the country include the fluctuation of the population of immigrants/travelers coming from malaria endemic countries, the maintenance of high level of health and public health services, physician awareness, and local environmental and climate conditions. Furthermore, free access to health services for immigrants (including undocumented ones) for timely diagnosis and treatment of malaria and achieving a minimum standard of their living conditions and well-being constitute determinant factors for preventing malaria re-establishment.

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 vulnerable areas of the country.

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 encouraged.