EPIDEMIOLOGICAL SURVEILLANCE REPORT
Malaria in Greece, up to 16/11/2013

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 1-4 weeks after infection with the parasite, while relapses of the disease are usually observed in short intervals but up to 5 and in extreme cases even up to 8 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.

Malaria is endemic in more than 100 countries around the world, 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 Centre for Disease Control and Prevention (HCDCP), the majority of which were travel related. Until 2008, sporadic malaria cases without reported travel history were recorded in 1991, 1999 and 2000.

Epidemiologic surveillance data

This data is derived from the reports of each laboratory-confirmed malaria case to the HCDCP. The Department of Epidemiologic Surveillance and Intervention undertakes a verification procedure through communication with the treating physicians, the hospital and the reference laboratories for malaria. Single case investigation is undertaken by the staff of the Department of Epidemiologic Surveillance for malaria cases without reported travel history and for all malaria cases in Evrotas, Lakonia, where a cluster of malaria cases was detected in 2011. In addition, for the same cases the staff undertakes a focus investigation, which involves active case detection in an area around each case’s place of residence or place of exposure taking into consideration entomological data. Residents in the focus are screened for symptoms compatible with malaria and followed up for fever in weekly intervals for a total of one month and in addition. Immigrants from malaria endemic countries in the focus are screened with one-round blood sample. 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 going to be closely monitored for the following three years.
Malaria epidemiologic surveillance data, 2009 - 2012

In 2009, a total of 51 laboratory confirmed cases of malaria were recorded in Greece, of which 44 imported and 7 without reported travel history to malaria-endemic areas, all *P. vivax* (6 cases in the Municipality of Evrotas, Lakonia and 1 sporadic case in East Attiki).

In 2010, a total of 44 laboratory confirmed cases of malaria were recorded in Greece, of which 40 imported and 4 without reported travel history to malaria-endemic areas all *P. vivax* (1 in the Municipality of Evrotas, Lakonia, 2 cases in Viotia and 1 case in East Attiki).

In 2011, a total of 96 laboratory confirmed cases of malaria were recorded in Greece, of which 54 imported and 42 without reported travel history to malaria-endemic areas all *P. vivax* (34 Greeks and 8 immigrants from non-endemic countries). A cluster of 36 *P. vivax* malaria cases with no travel history to malaria-endemic areas was reported in the Municipality of Evrotas, Lakonia along with 6 sporadic cases in Evia, Larisa, East Attiki and Viotia. (Epidemiological Surveillance Report- Malaria in Greece, 2011).

In 2012, a total of 93 laboratory confirmed cases of malaria were recorded in Greece, of which 73 imported and 20 without reported travel history to malaria-endemic areas (14 Greeks and 6 immigrants from non-endemic countries). All locally acquired cases were confirmed with *Plasmodium vivax* infection. Ten (10) of those patients were considered to be exposed in Evrotas (Lakonia), 2 in Marathon and 2 in Markopoulo (East Attiki), 2 in the Municipality of Avdira (Xanthi), 1 in the Municipality of Tanagra (Viotia), for one case the place of exposure was determined as the lake Paralimni (Viotia), and two (2) cases in the Municipality of Sofades, Karditsa. (see Epidemiological Surveillance report- Malaria in Greece-2012).

Malaria epidemiologic surveillance data, until 16/11/2013

In 2013 (up to 16/11/2013), a total of 20 laboratory confirmed cases of malaria have been reported to the HCDCP, of which 17 were classified as imported (10 cases in migrants from malaria endemic countries and 7 in returning travellers). Of the 17 imported cases, 8 cases are confirmed as *P. vivax* infections (7 migrants from malaria endemic countries and 1 in returning traveller) and 9 cases are confirmed as *P. falciparum* (3 migrants from malaria endemic countries and 6 in returning travellers).

The remaining three (3) *P. vivax* malaria cases refer to patients with Greek nationality with no travel history to a malaria endemic country and evidence of locally acquired infection; for the two cases in the Municipality of Alexandroupolis, Regional Unit of Evros and for one case in the Municipality of Sofades, Regional Unit of Karditsa (Figure 1). Symptom onset was in weeks 39/2013 (23-29/09/2013), 43/2013 (21-27/10/2013) and 44/2013 (28/10-3/11/2013), respectively.

The case classification by place of residence/exposure of all the malaria cases reported to the HCDCP in 2013 is presented in Table 1.
Table 1. Classification of reported malaria cases by place of residence/exposure, Greece, until 16/11/2013 (n=20)

<table>
<thead>
<tr>
<th>District of Residence</th>
<th>Classification of malaria cases</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Imported</td>
<td>Locally acquired cases</td>
</tr>
<tr>
<td></td>
<td>Immigrants from malaria endemic countries</td>
<td>Travelers to malaria endemic countries</td>
</tr>
<tr>
<td>West Section of Athens</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Central Section of Athens</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Eat Attiki</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Viotia</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Karditsa</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Larisa</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Messinia</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Piraeus</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Lakonia</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Evros</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10</strong></td>
<td><strong>7</strong></td>
</tr>
</tbody>
</table>
Figure 1: Place of residence/exposure of the malaria cases without reported travel history to malaria-endemic areas, Greece, 2013, until 16/11/2013 (n=3).
HCDCP activities for the management of malaria- 2013

During spring 2012 the HCDCP developed an Action Plan for the Management of Malaria 2012-2015, where the risk assessment for re-emergence of malaria in the different areas of Greece was included. 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 three 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» coordinated by the University of Thessaly, and include:

- Communication to the hierarchy of the Ministry of Health.
- Communication to the relevant regional department of public health.
- Communication to the National Centre for Blood Donation, responsible for the relevant blood safety measures.
- Enhancement of early detection of cases and focus investigation: HCDCP investigation teams are deployed after the detection of each malaria case to perform a “focus investigation”, as indicated by the epidemiological, entomological and environmental investigation. In this activity, all immigrants from malaria endemic countries in this area are tested for malaria, while individuals from non-endemic countries are screened for malaria compatible symptoms and/or tested for malaria accordingly.

HCDCP staff in collaboration with public health professionals from the regional department of public health and entomologists carried out the focus investigation of the malaria cases in the Municipality of Alexandroupolis, Regional Unit of Evros, between 12-14/10/2013. This involved the malaria screening of immigrants in an immigrant detention centre in the area with the assistance Médecins Sans Frontières (MSF Greece) field team, who operate a project in various detention centres in the area. HCDCP staff also carried out the focus investigation of the malaria case in the Municipality of Sofades, Regional Unit of Karditsa, between 13-15/11/2013, in collaboration with public health professionals from the regional department of public health and the University of Thessaly.

In addition, the HCDCP has supported and/or developed during 2013 a series of activities to prevent the re-establishment of malaria in Greece:

I. Enhance malaria surveillance:

   Active malaria case detection in the general and the migrant populations

   The HCDCP deployed a field team in the area of Evrotas, Lakonia from September 2011 to December 2012 and from April 2013 until now. The HCDCP field team collaborated from April to October 2012 with MSF-Greece for the prevention and investigation activities in the area, while support is also provided by the Municipality of Evrotas and local volunteers. This year the field staff is contracted via the national project «Integrated Surveillance and control programme for West Nile Virus and malaria in Greece» (www.malwest.gr).

   A significant number of immigrants from malaria endemic countries (Pakistan and Afghanistan, etc) live and work in Evrotas. 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 is performed regularly. During the 2012 transmission period 16 out of 17 malaria cases in immigrants were actively detected, all of whom were also treated with antimalarials under directly observed therapy (DOT). In 2013 fever screening visits were performed on average every 7-10 days (every 6-7 days during August-October) for the target population in the area.

Screening of immigrants for malaria
In 2013, HCDCP also recommended the screening of immigrants from malaria endemic countries in Health Units in North Aegean and Dodecanese islands, where undocumented immigrants are entering the country through the sea.

A geographical information system (GIS) tool was created for risk assessment (mapping of vectors, their breeding sites and malaria cases) in the framework of the above project.

II. Administration of antimalarial drugs to immigrants from malaria endemic countries. In 2012 HCDCP administered one course of prophylactic antimalarial treatment for P. vivax infection (Chloroquine+ Primaquine) to immigrants from malaria endemic countries residing in the Municipality of Evrotas with positive serology for malaria.

In 2013, 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 one course of antimalarials for P. vivax infection (Chloroquine + Primaquine) to all immigrants from malaria endemic countries who live in the Municipality Evrotas, mainly in the villages Skala, Leimonas, Agioi Taxiarches, Elos. This therapeutic intervention is provided using Directly Observed Treatment (DOT) protocols with the informed consent of the participating immigrants. The antimalarial course targets P. vivax hypnozoites in order to reduce the reservoir and interrupt transmission of the disease. Up to 16/11/2013, DOT antimalarial therapy has been administered to 791 persons.

III. Enhancing laboratory diagnosis of malaria: In 2013, HCDCP distributed Rapid Diagnostic Tests (RDTs) to hospitals and health centres that receive large populations of immigrants from endemic countries (large urban centers, areas with immigration detention centres) 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.

IV. Standardization of the malaria treatment: according to treatment guidelines developed by the HCDCP. In order to follow up the effectiveness of treatment a specific protocol is also recommended to monitor patients during and after treatment completion.

V. Increase awareness amongst health professionals for the diagnosis of malaria in affected and high risk areas. In 2013, HCDCP staff delivered talks and organized seminars for health professionals in 15 Health Centres and Hospitals in areas where locally acquired cases had occurred.

VI. Communication to the public on malaria and personal protection measures against mosquitoes: through public meetings and educational material developed by the HCDCP and available through the Centre’s website: www.keelpno.gr. A video with information on protection measures against mosquito bites was disseminated through TV Channels during the summer months.
VII. **Vector control activities- Entomologic Surveillance**

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 call for tenders of integrated vector control programs. In addition, individual reports were developed by the HCDCP including all entomological and epidemiological data for each region.

In the framework of the project “Integrated Surveillance and control programme for West Nile Virus and malaria in Greece”, a number of entomological activities were also carried out:

- identification of mosquitoes collected through entomological surveillance (NSPH, University of Thessaly, Benaki Phytopathological Institute)
- genetic identification of mosquitoes
- insecticide resistance studies:
  - for *Anopheles* spp. mosquitoes at the Benaki Phytopathological Institute and at the Laboratory of Molecular Entomology at the Biology Department, University of Crete and
  - for *Culex* spp. mosquitoes at the Laboratory of Entomology and Agricultural Zoology, University of Thessaly,
- testing of *Anopheles* spp. collected in Evrotas using molecular techniques for *Plasmodium* presence in the University of Crete,
- mosquito overwintering study (in-vitro and in-vivo),
- study on the comparison of effectiveness of various mosquito traps (Benaki Phytopathological Institute).

In addition, according to WHO and ECDC guidance, HCDCP implemented in the Municipality of Evrotas the following actions:

- distribution of 500 LLINs (Long Lasting Insecticide treated Nets) at the immigrants residences, under a special license by the Ministry of Agriculture,
- the 1st round of Indoor Residual Spraying (IRS) was performed in June 2013, using pyrethrins and covering 91% of migrant residences. In the context of testing the effectiveness of the sprayings, detection of residual activity is performed by bioassays (Benaki Phytopathological Institute) and residual biocide on the sprayed surfaces (University of Crete). Residual activity was followed up on a monthly basis and the 2nd round of IRS was undertaken by the Regional Authority of Peloponnese in early October 2013.

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

**Conclusions**

Greece has been malaria-free since 1974, but a number of significant factors may lead to the re-establishment of the disease, mainly:

(i) the large number of immigrants from malaria-endemic countries, who work mostly in the farming sector combined with

(ii) the circulation of *Anopheles* mosquitoes, the competent vector of the disease, in many areas of Greece (receptive areas).
Fewer locally-acquired malaria cases were recorded in 2012, compared with 2011 and minimal in 2013. Overall 52% decrease in locally acquired cases was noted in 2012 compared to 2011 and 72% decrease in locally-acquired cases in Evrotas, Lakonia. Furthermore, active case detection in Evrotas improved significantly the timeliness of diagnosis of malaria in the area. Locally acquired cases were minimal in 2013, partly due to the decreased number of immigrants as well as the public health interventions that were implemented in Lakonia. We believe awareness about malaria is still high.

**Early detection, appropriate investigation and appropriate treatment of malaria cases** combined with **effective vector control** (larviciding and IRS) represent the main components of the public health strategy to prevent further transmission and re-establishment of malaria in Greece.

**Advice for travelers to areas in Greece with reported locally-acquired malaria cases:**
The HCDCP, based on the surveillance data available until now and the implemented control measures in the areas where locally-acquired malaria cases have been reported, maintains that the **risk to travelers for malaria infection in Greece is very low.** For this reason, **chemoprophylaxis for malaria is not recommended** for visitors to areas where locally acquired malaria cases have occurred until today. However, personal protective measures against mosquitoes are strongly encouraged.