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Imported malaria in Bulgaria, status and prognosis after eradication in 1965

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ABSTRACT

Background: This retrospective analysis assessed all recorded malaria cases in Bulgaria after 1965, when the country was certified as malaria-free by the World Health Organization (WHO), and evaluated the readiness of the public health system to interrupt an outbreak of local transmission in case of infection importation.

Methods: The cases were analyzed according to causative species; geographic origin of the imported case; and the citizenship, age, and gender of the infected individuals.

Results: In the 50-year study period (1966–2015), there were a total of 3011 cases of malaria imported to Bulgaria from different regions of the world. The majority of the cases originating in Africa were caused by *Plasmodium falciparum* (65.5%), while most of these originating in Asia were caused by *P. vivax* (80.9%). The potential season for malaria transmission in Bulgaria is from April to October, and 58.5% of the malaria cases were imported during that time of the year.

Conclusions: The increasing movement of people to and from areas endemic for malaria requires the health authorities of countries with appropriate conditions for reintroduction to conduct enhanced measures for surveillance and control of this potentially deadly disease.

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Introduction

Malaria is a vector-borne protozoan disease and a serious medical and social problem for many countries. According to the World Health Organization (WHO), there were 214 million new malaria cases in 2015, 438,000 of which had lethal outcomes. Most cases were reported in Africa (88%), followed by Southeast Asia (10%) [1]. The increasing globalization and migration of people to countries with more developed economies and social policies reduce the differences in the epidemiology of infectious diseases in different parts of the world [2]. According to Eurostat, as of January 1, 2012, 20.7 million, or 4.1% of the population in the European Union (EU) was born outside its borders [3]. However, these data do not account for illegal immigrants whose numbers may range between 0.39%–0.77% [4] and 4% [5] of the populations of the 28 EU Member States. In this respect, questions about the importation of parasitic diseases that are not generally vaccine-preventable and the basic measures for their control, timely diagnosis, and treatment are increasingly relevant.

Historical data

Malaria has been an endemic disease in the Balkan Peninsula since ancient times. The disease, known as “swamp fever,” was prevalent in many parts of Bulgaria, particularly in the valleys along larger rivers and around the Black Sea coast [6]. Vivax malaria was predominant, followed by falciparum malaria and (rarely) malarial malaria. The high incidence of indigenous malaria during and after World War I was the reason for issuing the country’s first law to combat malaria in 1919. The measures proved insufficient, and between 1922 and 1930 the reported annual incidence of malaria increased from 1100 to 70,000 cases, peaking in 1946, when the country recorded 144,632 cases, corresponding to an incidence rate of 2057.5 per 100,000 in a population of 7,029,349 [7–11]. After World War II Bulgaria undertook extensive measures for the elimination of malaria, including the early detection and treatment of the infected individuals, insecticide treatment of vector habitats, irrigation measures in marshy areas, and mass chemoprophylaxis of the populations living in high-risk areas. As a result of these extensive and consistent measures, in 1965 Bulgaria was certified by the WHO as having eradicated autochthonous malaria transmission.

The objective of this study was to perform a retrospective analysis of all recorded malaria cases in Bulgaria after 1965 and to

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evaluate the readiness of the public health system to interrupt the outbreak of local malaria transmission in case of importation.

Methods

Data sources and analysis

Epidemiological, demographic, and medical information from epidemiological survey cards of individuals diagnosed with malaria was used (supplementary material). In addition, data from the National Reference Laboratory for the diagnosis of parasitic diseases (NRL) at the National Centre of Infectious and Parasitic Diseases (NCIPD) were used, as well as data from previous relevant studies. All imported malaria cases were examined for causative species; geographic origin; and citizenship, age, and gender of the infected individuals. The incidence rate was calculated per 100,000 population using official statistical data from the National Statistical Institute.

Data collection

The Bulgarian system of surveillance and control of parasitic diseases has several levels. At the regional level, measures are implemented by the Regional Health Inspectorates (RHI), which carry out primary diagnostics according to clinical, epidemiological, and prophylactic indications and also perform epidemiological surveys of diagnosed cases that are subject to mandatory registration and notification under the current regulations. The Department of Parasitology and Tropical Medicine (DPTM) at the NCIPD is the reference diagnostic and consulting authority in the country for local and imported parasitic diseases. It performs routine and confirmatory diagnosis of parasitic pathology as well as clinical work with patients in outpatient and hospital settings. The specialists at the DPTM prepare annual analyses of the recorded parasitic morbidity nationwide and present to the Ministry of Health (MoH) updated lists, along with measures to improve the surveillance and control of human parasitic diseases.

Laboratory diagnosis of malaria

In Bulgaria, the malaria is diagnosed by specialized parasitological laboratories at RHI, facilities for outpatient or hospital care, and the NRL at the NCIPD. The main diagnostic method is the microscopic examination of Giemsa-stained thick and thin blood smears. Recently, rapid diagnostic tests (RDTs) have also been used for the detection of circulating malaria-specific antigens. Most often used are the Malaria MBPan (Mascia Brunelli S.p.D., Italy), Malaria 4Species (Nadal Medical Test, Germany) and SD BIOLINE Malaria Antigen P.f (Standard Diagnostics Inc., Korea) RDTs. According to current legislation in Bulgaria, all diagnosed cases of malaria are subject to a confirmation of the species diagnosis by the NRL at the NCIPD. The NRL also has the technical abilities to perform biomolecular diagnostics using polymerase chain reaction (PCR). More recently, the commercial STAT-NAT Malaria Screening & Malaria Typing (Multiplex end-point PCR for malaria screening and typing, Sentinel CH. SpA – Italy) kit has been used.

Entomological data collection

The biotopes of the anopheline mosquitoes in the country are examined at the regional level by the RHI. The present study used these data as well as those of other Bulgarian investigators.

Surveillance and control of malaria in Bulgaria

In Bulgaria, malaria is subject to a mandatory notification. The post-eradication history of malaria surveillance and control can be divided into two periods, as described below.

First period (1965–1989)

After malaria eradication in 1965, control measures were carried out according to instructions issued by the MoH regarding malaria and other tropical parasitic diseases. The measures against malaria focused in two directions: at Bulgarian citizens traveling to endemic countries and Bulgarian and foreign citizens returning from such countries. The traveling citizens received free chemoprophylaxis depending on the country they were visiting as well as on the local resistance of *Plasmodium falciparum* to chloroquine. The medications used for this purpose were distributed free to the traveling citizens at the expense of the state budget. All Bulgarian and foreign citizens returning or coming from tropical countries were recorded by the “border sanitary control service”. These records were sent to the RHI, whose obligation was to examine those individuals for malaria and intestinal parasites. All patients diagnosed with malaria were hospitalized, epidemiological survey cards completed, and information sent to notify the MoH and NCIPD.

Second period (1989–present)

National political and socio-economic changes also led to changes in malaria control measures and surveillance. Due to the closure of the border sanitation services in 1989, the mandatory registration and follow-up of all Bulgarian citizens returning from endemic countries were eliminated. Since then, laboratory examination for malaria in these individuals is performed only according to clinical or epidemiological indications or by their own request. During the study period, the travelers received chemoprophylaxis in accordance with WHO recommendations; however, unlike the first period, it is not mandatory and is at the expense of the travelers themselves. The current Bulgarian legislation was updated in accordance with the existing European Union legislation and is based on three documents: Regulation #21 from 2005 issued by the MoH: “On the procedure of registration, notification and accounting of infectious diseases”; Regulation #5 from 2006 issued by the MoH: “On the diagnosis, prevention and control of local parasitic infections”; and Regulation #17 from 2008, issued by the MoH: “On the terms and conditions for conducting diagnosis, prevention and control of imported parasitic diseases”.

Results

Regions of acquisition

During the study period of 50 years after the eradication of malaria in Bulgaria, there were a total of 3011 recorded cases of malaria imported from different regions of the world. The majority of cases arrived from Africa, 52.7% (n = 1585); 45% (n = 1380) came from Asia and 1.5% (n = 46) from South America (Table 1). Most cases imported from Africa were from Nigeria (n = 384, 24.2%), Angola (n = 217, 13.7%), Ghana (n = 96, 6.1%), Guinea (n = 74, 4.7%), and Sudan (n = 65, 4.1%). During the study period, imported malaria cases from Asia were mainly from Vietnam (n = 951, 68.9%), India (n = 35, 2.5%), Afghanistan (n = 27, 1.9%), and Pakistan (n = 11, 0.8%). In most cases imported from Central and South America, the disease was acquired in Nicaragua (n = 43, 93.5%), Guyana (n = 2, 4.3%), and the Dominican Republic (n = 1, 2.2%).

Imported malaria according to resident status and Plasmodium species

The study period was we divided into decades. During the first decade (1966–1975), there were two and three recorded cases of imported malaria in 1966 and 1967, respectively, increasing gradually to 45 cases in 1975 (Table 2). In this period, a total of 132 cases of malaria were recorded, 70 (53%) of which were in Bulgarian citizens and 62 (47%) in foreign nationals from endemic countries.

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