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REVIEW

Chikungunya and dengue autochthonous cases in Europe, 2007–2012

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Summary A large number of autochthonous cases of dengue fever (2237) and chikungunya fever (231) occurred in Europe (Italy, France, Croatia, Madeira) during the period covered by our analysis (2007–2012). In all dengue outbreaks, the circulating strain, identified by means of molecular analysis, was the DENV-1 strain.

Dengue and chikungunya are infectious diseases that often result in hospitalizations and are associated with high public health costs. The dengue epidemic on the island of Madeira resulted in 122 hospitalizations. Only one death (from chikungunya) occurred but long-term sequelae were described after the chikungunya outbreak in Emilia-Romagna, Italy.

Vector control is key to reducing the impact of these diseases. During the chikungunya outbreak in Italy and the dengue outbreak in Madeira, appropriate measures for the control of mosquitoes (*Aedes aegypti and Aedes albopictus*) were effectively implemented. The effectiveness of these measures (reducing the number of breeding sites, application of pesticides and insecticides, public health education) was shown in the context of these real-life outbreaks.

All the pre-requisites for autochthonous transmission of both dengue virus and chikungunya virus (vectors, viremic returned travellers, climatic conditions) are present in Europe. Constant surveillance is imperative.

Introduction

The threat of the possible establishment of dengue virus (DENV) and chikungunya virus (CHIKV) in the Northern Hemisphere has aroused the attention of the scientific community. These two viruses need a competent vector to be transmitted. Mosquitoes of *Aedes* species (*Stegomyia*

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aegypti and *Stegomyia albopictus*)[1] are such competent vectors expanding in all continents of the Northern Hemisphere, representing a main risk factor for the establishment of these emerging viral diseases. Chikungunya virus (CHIKV) is an arbovirus belonging to the genus *Alphavirus*, of the family *Togaviridae*. It has an incubation period of 2—6 days. During the last decade, epidemics occurred, starting in 2004 in Kenya and then spreading mainly across the islands of the Indian Ocean and India. In early 2005, the epidemic reached the Comoros islands, where between January and May almost two thirds of the population were infected with the virus (estimated over 215,000 infections). In May 2005, the first cases of chikungunya fever were detected on the island of La Réunion, and these numbers climbed to almost 266,000 cases up to 2007. The virus has also been introduced to the Seychelles, Mauritius, Maldives and other Indian Ocean islands. In India, an epidemic starting in 2005 resulted in millions of infections over the course of over 3 years [1—4]. Chikungunya fever is an acute illness, which presents with a sudden onset with high fever ($\geq$39 °C), myalgia, headache, fatigue and characteristic symptoms like severe joint pain and maculopapular rash. Joint pain, which appears during the acute phase, can evolve afterward in chronic arthritis. Nausea and vomiting are also frequently seen. The acute phase, which lasts 7—10 days, may develop into a chronic phase with disabling rheumatic manifestations, such as polyarthritis-like symptoms that can last several months. Neurological manifestations (especially in children), fetal infections and deaths were recorded during the large Indian outbreak [1].

Dengue virus (DENV) is an arbovirus belonging to the *Flavivirus* genus of the *Flaviviridae* family. DENV has an incubation period ranging from 3 to 14 days (on average 4—7 days) [5,6]. There are four antigenically different serotypes of the virus (DENV-1/DENV-2/DENV-3/DENV-4). Infection with one serotype provides lifelong immunity to the same serotype but only temporary immunity to the others. Human infection with the dengue virus presented with a wide clinical presentation, ranging from asymptomatic to subfebrile to severe illness. The last dengue Classification suggested by the World Health Organization (WHO 2009) differentiates these two forms: Dengue (with or without warning signs) and Severe Dengue (defined by severe plasma leakage or severe bleeding or severe organ impairment). The previous classification (WHO 1997), which is still the most widely used, distinguished between Dengue Fever (DF), Dengue hemorrhagic fever (DHF Grad I—II) and Dengue shock syndrome (DSS or DHF Grad III—IV) [7].

In the last two decades dengue fever has become one of the most common mosquito-borne disease, appearing today in more than 120 tropical and subtropical countries with approximately 2.5 billion persons at risk of infection. In 2009, the WHO estimated the number of infections at about 50 million per year. In fact, the incidence of dengue fever has increased 30-fold over the last 50 years [8,9]. This trend is due to the increased amount of international air travel, increased global trade, and the effects of global climate change, all being factors that contribute to the geographical expansion of the disease's vectors, *Aedes* spp, which can even survive cargo ship travel [10].

[1] In this paper, we use only the term *Aedes* (from the Ancient Greek, meaning "odious" or "unpleasant") to describe these two species.

Objectives

The objectives of this analysis were to document locally occurring (autochthonous) cases of chikungunya and dengue fever in Europe and to describe risk factors for further outbreaks.

Methods

For this analysis, data were collected from English, French, Italian and Portuguese published papers. The cut-off date for the publication search was January 6th 2013. For the bibliographic research, PubMed was used and also on-line archives of Eurosurveillance, European Center of Disease Prevention and Control (ECDC), General Directorate for Health (DGS) in Portuguese and Health Administration Institute and Health Affairs of Madeira (IASAUDE) in Portuguese. The keywords used to search in PubMed were: ["Dengue AND Europe" OR "Chikungunya AND Europe"], "Dengue AND Portugal", "Chikungunya AND Italy". The Public Health Service (Servizio Sanità Pubblica) of Emilia-Romagna Region was also contacted for some data.

Results

The searches using the keywords gave the following results: ["Dengue AND Europe" OR "Chikungunya AND Europe" (Title/Abstract)] = 151 results, ["Dengue AND Portugal" (Title/Abstract)] = 7 results, ["Chikungunya AND Italy" (Title/Abstract)] = 80 results. From these publications, we selected 18 articles from Pubmed, 19 bulletins and circular information from Direcção-Geral da Saúde (General Directorate for Health, DGS) and Instituto de Administração da Saúde e Assuntos Sociais da IP-Região Autonoma da Madeira (Institute for the Administration of Health and Social Affairs, IP-Autonomous Region of Madeira, IASAUDE) both in the Portuguese language, 5 weekly bulletins and 2 Rapid Risk Assessments from ECDC, to describe and quantify the European autochthonous cases. From the Public Health Service of Emilia-Romagna region we obtained additional data from a retrospective analysis.

Autochthonous cases of chikungunya fever in Europe

In the summer of 2007, autochthonous cases of chikungunya occurred for the first time in Europe, in Italy. The infection developed as an outbreak in the period from July to September. The first case was a man living in Castiglione di Cervia, a small village in the province of Ravenna, who developed a febrile illness on the 4th of July and had no recent travel history. In the middle of August, after many similar cases occurred, the health authorities began to investigate. Chikungunya was suspected because of the concomitant symptomatic and the known presence