World Health Organization
REGIONAL OFFICE FOR Europe

Zika virus vectors and risk of spread in the WHO European Region

Summary

The largest outbreak of Zika virus disease ever recorded began in the continental Americas in 2015. Since then, the geographical distribution of Zika virus has steadily widened, and local transmission has been reported broadly in the Region of the Americas.

In the European Region, the risk of local Zika virus transmission is low during the winter season, as the mosquito is still inactive. In late spring and summer, the risk for spread of Zika virus increases. While *A. aegypti* is the primary Zika vector, *A. albopictus*, which is present in 20 European countries, has been shown to be able to transmit Zika virus and remains a potential vector for its spread.

European countries, especially those in which *A. aegypti* and *A. albopictus* are present, should be well prepared to protect their populations from the spread of Zika virus disease and its potential neurological complications, including microcephaly.

Two main *Aedes* mosquito species for transmission of Zika virus

Zika virus (in the family Flaviviridae, genus *Flavivirus*) is transmitted by female *Aedes* mosquitoes. The primary *Aedes* species vector of Zika virus worldwide is *A. aegypti,* which is responsible for the current outbreak in the Americas. *A. albopictus* has been shown to be able to transmit Zika virus in Africa and in laboratory settings.

The ability of the mosquito to transmit Zika virus is based on the combination of its competence and capacity.

- **Vector competence** is a vector's biological capability to transmit a virus.
- **Vector capacity** is the efficiency with which the mosquito transmits a disease, which is based on its preferred host, the number of bites (feedings) per cycle of egg production, its longevity, the density of the mosquito population and other factors.

The vector competence of *A. aegypti* and *A. albopictus* is similar. A. *albopictus* is considered to have lower vector capacity than *A. aegypti* for transmitting arboviruses (viruses transmitted by insects), including Zika; however *A. albopictus* was the primary vector in recent arboviral outbreaks in Europe.

Comparison of *A. aegypti* and *A. albopictus*:

A. aegypti	***A. albopictus***
bites primarily humans (*anthropophilic*)	bites primarily wild and domestic animals (*zoophilic*) but also humans
tends to bite indoors	tends to bite outdoors
feeds multiple times per cycle of egg production	feeds once per cycle of egg production
adapts well to human urban settlements	inhabits rural and urban areas

Other species of *Aedes* and other types of mosquito

Although Zika virus has been isolated in numerous other species of the *Aedes* mosquito family, as well as in *Anopheles coustani*, *Mansonia uniformis* and *Culex perfuscus*, none has been proven to acquire the virus and transmit it in a laboratory setting.

In the European Region, additional *Aedes* species (namely *A. atropalpus, A. koreicus, A. triseriatus, A. japonicus*) are known to be able to transmit other *Flaviviruses*. However, at present, there is no evidence that they can transmit Zika virus or adapt to urban environments.

Distribution of *A. aegypti* and *A. albopictus* in countries in the European Region

- *A. aegypti* originates from West Africa and has been identified in Europe in the past. It has been reported recently in limited areas of the European Region, namely Madeira island and the north-eastern Black Sea coast (Georgia and the southern part of the Russian Federation).
- *A. albopictus* is native to south-east Asia. In the European Region, it is established primarily in the Mediterranean basin and in particular in Albania, Bosnia and Herzegovina, Bulgaria, Croatia, France, Germany, Georgia, Greece, Israel, Italy, Malta, Monaco, Montenegro, Romania, San Marino, Slovenia, Spain, Switzerland, Turkey and Vatican City.

Outbreaks of dengue (Madeira, Portugal, in 2012 and Croatia and France in 2010) and chikungunya (Italy in 2007) have been reported in the Region in the past few years. In all these cases, *A. albopictus* was the main vector, except in Madeira, where it was *A. aegypti*.

Risk of spread of Zika virus in the WHO European Region

The risk for an outbreak of Zika virus disease in the European Region should not be underestimated. The potential link with microcephaly and neurological disorders is of particular concern.

As seen in previous arboviral outbreaks in the Region, infected travellers returning to parts of Europe in which *A. aegypti* or *A. albopictus* mosquitoes are present could initiate local virus transmission. If local transmission were to occur, several factors could contribute to the risk of an outbreak:

- high densities of *A. aegypti* and *A. albopictus* in several countries in the European Region where the mosquitos are established;
- favourable ecological and climatic conditions for establishment of *A. aegypti* and *A. albopictus* in several countries in which the vector is not currently present;
- numerous infected travellers returning from affected areas, due to high global mobility;
- sufficient human population density in countries in which *A. aegypti* and/or *A. albopictus* are currently present or could be established;
- lack of immunity of the European population to Zika virus disease, due to lack of previous exposure; and
- difficulty in detecting local transmission early, as 3 of 4 people infected with Zika virus do not show symptoms.

A number of travellers infected with Zika virus in the Americas have entered Europe, but the disease has not been transmitted further during the winter season, as the mosquitos are inactive. In spring and summer, however, the risk of Zika virus disease transmission in Europe will increase, as mosquitoes find better breeding grounds in warmer weather. Country-specific risks will depend on the introduction or presence of the vector and the country's capacity to detect and respond to spread.

Preparedness in countries in which *A. aegypti* and *A. albopictus* are present

European countries, especially those in which *A. aegypti* and *A. albopictus* are present, should be well prepared to decrease the risk for local transmission of Zika virus. There are four main pillars for effective preparedness for and response to the spread of Zika virus disease and the potential neurological disorders and neonatal malformations:

1. vector surveillance and control strategies to decrease vector density, in line with the regional framework for surveillance and control of invasive mosquito vectors and re-emerging vector-borne diseases;
2. Zika virus disease surveillance, through strong early warning systems;
3. early confirmation of local transmission of Zika virus and of any complications (microcephaly and Guillain-Barré syndrome) based on robust clinical and laboratory capacity; and
4. risk communication to groups at risk, including pregnant women.

Specific guidance documents for Zika virus can be found at http://www.euro.who.int/en/health-topics/emergencies/microcephalyzika-virus/technical-reports-and-guidelines-on-zika-virus

References

Ayres C FJ. Identification of Zika virus vectors and implications for control. Lancet Infect Dis Feb 4. pii: S1473-3099(16)00073-6. doi: 10.1016/S1473-3099(16)00073-6.

Chouin-Carneiro T, Vega-Rua A, Vazeille M, Yebakima A, Girod R, Goindin D, et al. Differential susceptibilities of Aedes aegypti and Aedes albopictus from the Americas to Zika virus. PLoS Negl Trop Dis 2016;10:e0004543.

Diallo D, Sall AA, Diagne CT, Faye O, Faye O, Ba Y, et al. Zika virus emergence in mosquitoes in southeastern Senegal, 2011. PLoS One 2014;9:e109442.

European Centre for Disease Prevention and Control. Update on autochthonous dengue cases in Madeira, Portugal. Stockholm; 2013 (http://ecdc.europa.eu/en/publications/Publications/dengue-madeira-risk-assessment-update.pdf, accessed 11 March 2016).

Faye O, Faye O, Diallo D, Diallo M, Weidmann M, Sall AA. Quantitative real-time PCR detection of Zika virus and evaluation with field-caught mosquitoes. Virol J 2013;10:311.

Grard G, Caron M, Mombo IM, Nkoghe D, Mboui Ondo S, Jiolle D, et al. Zika virus in Gabon (Central Africa)--2007: a new threat from Aedes albopictus? PLoS Negl Trop Dis 2014;8:e2681.

Gratz NG. Critical review of the vector status of Aedes albopictus. Med Vet Entomol 2004;18:215–227.

Lambrechts L, Scott TW, Gubler DJ. Consequences of the expanding global distribution of Aedes albopictus for dengue virus transmission. PLoS Negl Trop Dis 2010;4:e646.

Schaffner F, Mathis A. Dengue and dengue vectors in the WHO European Region: past, present, and scenarios for the future. Lancet Infect Dis 2014;14:1271–1280.

Scott TW, Takken W. Feeding strategies of anthropophilic mosquitoes result in increased risk of pathogen transmission. Trends Parasitol 2012; 28:114–121.

Vasilakis N, Cardosa J, Hanley KA, Holmes EC, Weaver SC. Fever from the forest: prospects for the continued emergence of sylvatic dengue virus and its impact on public health. Nat Rev Microbiol 2011;9:532–541.

Vazeille M, Mousson L, Rakatoarivony I, Villeret R, Rodhain F, Duchemin JB, et al. Population genetic structure and competence as a vector for dengue type 2 virus of Aedes aegypti and Aedes albopictus from Madagascar. Am J Trop Med Hyg 2001; 65:491–497.

Wong PS, Li MZ, Chong CS, Ng LC, Tan CH. Aedes (Stegomyia) albopictus (Skuse): a potential vector of Zika virus in Singapore. PLoS Negl Trop Dis 2013;7:e2348.