

# INFECTIOUS DISEASES in a CHANGING CLIMATE

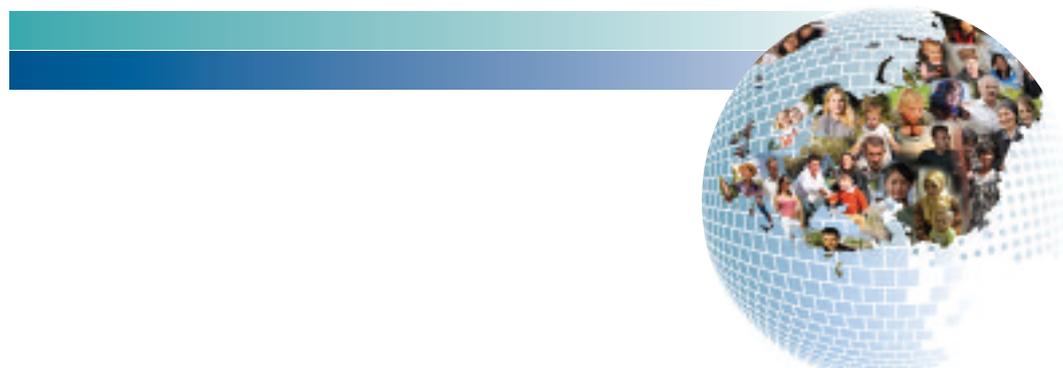


## Information for public health officials in the WHO European Region

The frequency and distribution of many infectious diseases are changing under a changing climate. Recent outbreaks of dengue, chikungunya and West Nile virus in countries previously free from these diseases signal just some of the potential threats associated with changes in climate, trade, travel and the environment.

This series of information sheets on infectious diseases in a changing climate aims to highlight current and future risks in countries of the WHO European Region, and to provide public health authorities with information on the scale of the problem and measures for prevention and response.

Each information sheet is based on large systematic literature reviews and expert advice. Where WHO guidelines are available, this information is reproduced.





# DENGUE in the WHO EUROPEAN REGION

This information leaflet is intended to guide public health authorities in protecting their populations from the health risks of dengue. The following sections will answer five key questions.

## 1. Dengue is back.

What are the risks of re-established transmission of dengue in countries of the European Region?

## 2. Dengue can be severe.

What are the health effects of dengue infection?

## 3. Dengue can be prevented and controlled.

What can you do?

## 4. WHO can assist you.

What support could you get?

## 5. Guidance is available.

Which documents provide guidance on effective prevention and control activities?



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## Key messages

- In Europe, dengue is second only to malaria as the febrile illness causing most hospitalization after return from abroad.
- After many years with only a few cases reported, dengue is back in the WHO European Region<sup>1</sup> – more than 3000 cases have been reported in the last three years, principally due to imported cases and the presence of *Aedes* vectors for local transmission.
- The spread of *Ae. aegypti* and *Ae. albopictus* (tiger mosquito or forest day mosquito) is a growing problem driven by the globalization of trade and travel, increased urbanization and climate change. Vectors transmit the pathogens not only for malaria and dengue, but also for chikungunya and yellow fever (for example). Integrated vector control measures are essential.
- Severe dengue is a potentially lethal complication of dengue infection. So far, there is neither specific treatment nor a vaccine. However, early diagnosis and adequate management can reduce fatalities.
- Public health authorities need to strengthen prevention, preparedness and control of the disease and improve communication on the best ways to control mosquitoes.

<sup>1</sup> The WHO European Region comprises 53 countries stretching from the Atlantic Ocean to the Pacific, with a population of almost 900 million.



# 1. Dengue is back

- Dengue is a febrile viral infection caused by four different viruses (dengue virus serotypes 1–4) that are transmitted by *Aedes* mosquitoes.
- Travellers (workers, tourists, migrants) returning from countries where diseases are endemic are increasingly introducing dengue and other vector-borne viruses into the WHO European Region.
- In areas where the mosquito species *Ae. aegypti* or *Ae. albopictus* are established or re-established, there is a genuine risk of local transmission.

## Dengue is spreading in the WHO European Region again

Until 1930, dengue fever was endemic in the countries of southern Europe where the vector *Ae. aegypti* was present. In 1927 and 1928, several outbreaks in Greece and Turkey affected more than a million people and killed up to 1500. After that, the disease disappeared.



Man-made sites: vases and flower pot dishes

The threat of dengue in Europe has increased in the last few years. Recent locally transmitted dengue cases in Croatia, France and Portugal have shown that transmission is possible in different areas of continental Europe where *Ae. albopictus* or *Ae. aegypti* are present.

A large outbreak has occurred in Madeira, Portugal – more than 2100 cases were declared from October 2012 to May 2013, at least 80 requiring hospitalization. An additional 78 cases were reported among European travellers returning from the island. This outbreak has led to reports of the spread of cases into 14 other European countries.

## Vectors of dengue

Currently, the two re-emerging vectors (*Ae. aegypti*, *Ae. albopictus*) lead to local transmission of the disease.

*Ae. albopictus* is reported to be widely established and spreading in the western Mediterranean basin, from Spain to Greece. It was found only recently in more eastern countries and around the Black Sea coast (Bulgaria, Georgia, Romania, southern Russian Federation, Turkey). A few mosquitoes have been found in more northern countries but no establishment has been confirmed, to date. Once the mosquito is established it is very difficult to eliminate.

*Ae. aegypti* was widespread in southern Europe until the early 1950s. Re-introductions are now occurring and the species is established on Madeira and the northern Black Sea coast.

Both *Ae. aegypti* and *Ae. albopictus* can transmit other viral pathogens (e.g. for West Nile virus, yellow fever, St. Louis encephalitis and chikungunya).

## Dengue is driven by climate change, trade and travel

Changes in the European climate have impacts on vector distribution and potential disease transmission.

- Annual mean temperatures of 15°C for *Ae. aegypti* and 11°C for *Ae. albopictus* seem to be indicative thresholds for the persistence of these vector populations.
- Higher temperatures favour larval development and mosquito adult emergence rate activity.
- Higher rainfall increases the number of flooded breeding sites. Lower rainfall prompts people to store water – mosquitoes use the containers as breeding sites.
- Humidity influences mosquito lifespan and therefore the potential for virus transmission.
- Cold spells with winter frosts are expected to limit the survival of *Aedes*' eggs, but some cold countries are experiencing temporary summer expansions. *Ae. albopictus* survival and winter-rest behaviour in Europe needs further investigation.

## 2. Dengue can be severe

### Dengue infection

People with dengue fever begin to develop illness seven days after being bitten by an infectious mosquito. It is difficult to distinguish dengue fever from other viral diseases in the earlier phase. Symptoms can include sudden fever; chills; severe headache with pain behind the eyes; muscle and joint pain and extreme fatigue; abdominal pain; nausea and vomiting; and a faint red rash on the upper body. The fever typically lasts around six days.

Recovery from infection caused by one serotype of dengue virus provides lifelong immunity against that particular serotype, but not cross-protective immunity against the other serotypes. Subsequent infections by other serotypes increase the risk of developing severe dengue.

### Severe dengue

Severe dengue is a potentially lethal complication of dengue infection. Two variants exist – dengue haemorrhagic fever (DHF) and dengue shock syndrome (DSS).

DHF and DSS symptoms include fever; a low platelet count; haemorrhagic bleeding and vascular permeability. DHF is sometimes associated with severe shock syndrome caused by fluid leaking into body tissues, characterizing the life-threatening DSS.

People who develop DHF have a 5% chance of death, but this can be as high as 40% if DSS develops. Infants, young children and elderly people are more susceptible to DSS.



### 3. Dengue can be prevented and controlled

The lack of a vaccine or specific treatment, in combination with the wide presence of *Ae. aegypti* and *Ae. albopictus* in parts of the European Region, make preventive measures necessary. These require the active participation of all sectors of society, as outlined in the three phases for health protection.

#### ■ Phase 1. Beat the vector

At present, stopping the invasion of *Aedes*-transmitting mosquitoes is the only method to prevent or control the transmission of dengue virus. In the European context, this includes (as a priority) early detection and swift elimination of incursions of *Ae. aegypti* in settlement areas, as well as preventing the establishment of *Ae. albopictus*.

Public health authorities should promote sustainable ways to avoid mosquito bites by preventing the introduction, establishment and spread of invasive mosquitoes, as well as their early detection and containment. This can be achieved by communication and community participation and mobilization for sustainable vector control.

#### ■ Phase 2. Stop spreading of the disease

Where introduction of mosquitoes could not have been avoided and the vectors have established in the environment, integrated surveillance of invasive mosquitoes and prevention of disease outbreaks should take place. Strategies and activities listed in Table 1 (points 2–5) outline relevant activities.

#### ■ Phase 3. Limit the burden of disease

To avoid a larger outbreak of dengue, active methods for early disease identification and case management are required in addition to Phases 1 and 2.

Further research is required in the European Region, including assessment of the effectiveness of control programmes for invasive mosquitoes and re-emerging diseases.



**Table 1. Principal strategic approaches and core activities for control of invasive mosquitoes and re-emerging disease**

Phase	Strategic approach	Core activities
<b>Phase 1.</b> <b>Beat the vector</b>	1. Sustainable vector control and early detection and containment of invasive mosquitoes	<ul style="list-style-type: none"> <li>• Prevent introduction of invasive mosquitoes by:               <ul style="list-style-type: none"> <li>o proper disposal of solid waste and removal of artificial water containers;</li> <li>o covering domestic water storage containers, and emptying and cleaning on a weekly basis;</li> <li>o application of appropriate insecticides to outdoor water storage containers;</li> <li>o use of personal and household protection such as window screens, long-sleeved clothes, insecticide-treated materials, repellents;</li> <li>o use of biological control agents in water bodies, where feasible;</li> <li>o mosquito detection at points-of-entry and high-risk sites;</li> <li>o prompt elimination of foci of colonization.</li> </ul> </li> </ul>
<b>Phase 2.</b> <b>Stop spreading of the disease</b>	2. Integrated surveillance and prevention of outbreaks 3. Awareness raising about invasive mosquitoes and re-emerging vector-borne diseases 4. Regional and bilateral coordination 5. Capacity development and resource allocation	<ul style="list-style-type: none"> <li>• Develop integrated system of vector and disease surveillance.</li> <li>• Prepare for disease outbreak response.</li> <li>• Improve disease diagnosis and case management.</li> <li>• Promote sustainable vector control to prevent transmission.</li> <li>• Generate political support.</li> <li>• Implement communication strategies for travellers and residents.</li> <li>• Promote integrated vector management and control.</li> <li>• Affect positive behaviours in prevention programmes through risk communication.</li> <li>• Coordinate and harmonize prevention, surveillance and control.</li> <li>• Coordinate and harmonize registration of biocides.</li> <li>• Develop human capacity and resources for surveillance and control of vectors and disease.</li> <li>• Establish network of reference centres.</li> </ul>
<b>Phase 3.</b> <b>Limit the burden of disease</b>	6. Detection, outbreak and case management and research	<ul style="list-style-type: none"> <li>• Ensure early identification of dengue cases</li> <li>• Improve care of severe dengue (DHF/DSS) and referral systems for patients.</li> <li>• Reorient health services to cope with dengue outbreaks.</li> <li>• Train health personnel at all levels of the health system.</li> </ul>

## 4. WHO can assist you

To assist Member States in reducing the risks of re-emergence of dengue and other vector-borne infectious diseases, WHO Regional Office for Europe has developed the *Regional Framework for Surveillance and Control of Invasive Mosquito Vectors and Re-emerging Vector-borne Diseases 2014–2020*. Further, these risks are addressed in *Protecting Health in an Environment Challenged by Climate Change: European Regional Framework for Action* and the Commitment to Act of the Fifth Ministerial Conference on Environment and Health. Thus, WHO Regional Office for Europe is pursuing an active role and can provide assistance in the following areas.



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Man-made sites: unused swimming pool

**Anticipation of risks:** WHO is working in partnership with other agencies in anticipating potential risks from the re-emergence of invasive mosquitoes and vector-borne diseases, particularly at the animal-human-ecosystem interface.

**International Health Regulations (IHR):** WHO assists Member States in implementing IHR-related capacity building relevant for dengue control. Prevention of mosquito invasions and disease emergence serves the IHR requirement for Member States to manage acute public health events that can cross borders, by developing and strengthening capacities at designated ports, airports and ground crossings.

**Sharing of methods:** WHO uses regional and bilateral collaboration and coordination to share methods for surveillance, risk assessment, information sharing and control measures and provide guidance to implement these methods.

**Partnerships:** concerns over invasive mosquitoes and their role in local transmission and outbreaks of dengue and chikungunya have prompted WHO, the European Commission, European Centre for Disease Prevention and Control and the European Mosquito Control Association to work together to raise awareness of the problem and to advise countries on surveillance and control activities.

## 5. Guidance is available

### WHO documents

Berg H van den, Velayudhan R, Ejov M (2013). *Regional framework for surveillance and control of invasive mosquito vectors and re-emerging vector-borne diseases 2014–2020*. Copenhagen, WHO Regional Office for Europe.

Initiative for Vaccine Research (IVR) (2013). *Dengue vaccine research*. Geneva, World Health Organization ([http://www.who.int/vaccine\\_research/diseases/dengue/dengue\\_vaccines/en/index.html](http://www.who.int/vaccine_research/diseases/dengue/dengue_vaccines/en/index.html)).

WHO (2013). *Dengue and severe dengue. Fact sheet No. 117*. Geneva, World Health Organization (<http://www.who.int/mediacentre/factsheets/fs117/en/index.html>).

WHO (2012). *Global strategy for dengue prevention and control 2012–2020*. Geneva, World Health Organization ([http://apps.who.int/iris/bitstream/10665/75303/1/9789241504034\\_eng.pdf](http://apps.who.int/iris/bitstream/10665/75303/1/9789241504034_eng.pdf)).

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WHO Regional Office for Europe (2010). *Protecting health in an environment challenged by climate change: European regional framework for action*. Copenhagen ([http://www.euro.who.int/\\_\\_data/assets/pdf\\_file/0005/95882/Parma\\_EH\\_Conf\\_edoc06rev1.pdf](http://www.euro.who.int/__data/assets/pdf_file/0005/95882/Parma_EH_Conf_edoc06rev1.pdf)).

WHO Regional Office for Europe (2010). *Parma declaration on environment and health and commitment to act. Fifth Ministerial Conference on Environment and Health, Parma, 10–12 March 2010*. Copenhagen ([http://www.euro.who.int/\\_\\_data/assets/pdf\\_file/0011/78608/E93618.pdf](http://www.euro.who.int/__data/assets/pdf_file/0011/78608/E93618.pdf)).

### External resources

ECDC (2013). *Dengue fever*. Stockholm, European Centre for Disease Prevention and Control ([http://www.ecdc.europa.eu/EN/HEALTHTOPICS/DENGUE\\_FEVER/Pages/index.aspx](http://www.ecdc.europa.eu/EN/HEALTHTOPICS/DENGUE_FEVER/Pages/index.aspx)).

ECDC (2012). *ECDC technical report: guidelines for the surveillance of invasive mosquitoes in Europe*. Stockholm, European Centre for Disease Prevention and Control (<http://ecdc.europa.eu/en/publications/Publications/TER-Mosquito-surveillance-guidelines.pdf>).

VBORNET (2013). *VBORNET maps*. Stockholm, European Network for Arthropod Vector Surveillance for Human Public Health (<http://www.vbornet.eu/index.php?p=11>).

Wellcome Trust (2005). *Dengue transmission*. In: *Topics in international health – dengue*. London (<http://www.who.int/tdr/publications/documents/dengue-life-cycle.swf>).

# DENGUE in the WHO EUROPEAN REGION



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