



## ➤ Tick-borne encephalitis

# Factsheet

for health practitioners



## Name and nature of infecting organism

**T**ick-borne encephalitis (TBE) is a viral infectious disease that attacks the central nervous system and can result in long-term neurological symptoms, and even death. TBE is caused by a virus (*Flavivirus* genus, family *Flaviviridae*) which includes three subtypes:

1. European subtype, transmitted by *Ixodes (I.) ricinus* ticks, can be found in rural, forested areas of Europe;
2. Siberian subtype, transmitted by *I. persulcatus*, endemic in Urals region, Siberia and far-eastern Russia, and also in some North-Eastern European Union countries.
3. Far eastern subtype, transmitted mainly by *I. persulcatus*, endemic in far-eastern Russia and in forested regions of China and Japan;

TBE has become a growing public health challenge in Europe and other parts of the world. The number of human cases of TBE in all endemic regions of Europe has increased by almost 400% in the last 30 years; the risk areas have spread and new foci have been discovered.

## Transmission

### Reservoir

Competent reservoir hosts of TBE virus are mainly small rodents (voles, mice), and insectivores (shrews). Indicator hosts supporting virus circulation indirectly by enabling tick multiplication are different species of wild and domestic mammals (especially hares, deer, wild boar, sheep, cattle, goats). Humans are incidental and dead-end hosts.



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### Transmission mode

TBE virus is transmitted by the bite of infected ticks. Humans may acquire infection also by consumption of infected unpasteurised dairy products. TBE virus is not directly transmitted from human to human, apart from the possibility of vertical transmission from an infected mother to the foetus. Laboratory accidents from needle-stick injuries or associated with aerosol infection have been reported.

Infected ticks can be found in woodland habitats — deciduous forests and transition zones between forests and grasslands. When infected, ticks can transmit the virus throughout their life (mainly nymphs and adults). Tick activity and life cycle depend on climatic factors (temperature, soil moisture and relative humidity). Wet summers and mild winters tend to increase tick population density. However, sporadic cases during the cold season are also reported especially in the southern European countries. In central Europe two peaks of activity of *I. ricinus* have been observed: in April/May and in September/October. In colder regions of northern Europe and in mountain regions a single summer peak is detected. Questing ticks are found mainly on low-lying vegetation but also on brushes located at human eye-level.



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## Clinical features

The incubation period of TBE is seven days on average, but incubation of up to 28 days has been described. The incubation after food-borne infection is usually shorter, around four days.

- Approximately two thirds of human TBE virus infections are non-symptomatic. In clinical cases, TBE often has a biphasic course. The first viraemic phase lasts five (range 2-10) days, and is associated with non-specific symptoms (fever, fatigue, headache, myalgia, nausea). This phase is followed by an asymptomatic interval lasting seven (range 1-33) days that precedes the second phase, when the central nervous system is involved (meningitis, meningoencephalitis, myelitis, paralysis, radiculitis).
- The European subtype is associated with milder disease, with 20-30% of patients experiencing the second phase, mortality rates of 0.5-2%, and severe neurological sequelae in up to 10% of patients. In children, the second phase of illness is usually limited to meningitis, whereas adults older than 40 years are at increased risk of developing encephalitis, with higher mortality and long-lasting sequelae in those over the age of 60.
- The Siberian subtype is associated with the tendency to cause chronic infections in humans.
- The far eastern subtype is associated with more severe disease: monophasic illness, with no asymptomatic interval preceding the onset of neurological disease, mortality rates of up to 35%, and higher rates of severe neurological sequelae.



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### Risk groups

In endemic areas, people with recreational or occupational outdoor activities (e.g. hunting, fishing, camping, collecting mushrooms and berries, hiking, forestry and farming) are potentially at risk of infection by contact with infected ticks.

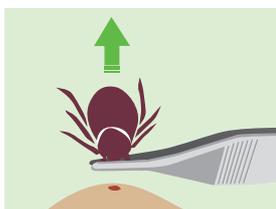


### Prevention measures

TBE virus infection can be prevented by avoiding tick bites:

- application of insect repellents to exposed skin.
- wearing protective clothing with long sleeves and long trousers tucked into socks treated with insecticides.
- avoiding consumption of unpasteurised milk and dairy products in risk areas.

Inspecting the body for ticks after outdoor activities and removing ticks with tweezers or forceps is also important because tick can harbour other pathogens.



**Vaccination against TBE (inactivated vaccine) is considered to be the most effective means of preventing TBE in endemic countries.**

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### Diagnosis

The diagnosis of TBE is based on the detection of specific IgM antibodies in cerebrospinal fluid (intrathecal production) and/or serum, mainly by ELISA. TBE antibodies appear 0-6 days after the onset and are usually detected when neurological symptoms are present. Specific IgM antibodies can persist for up to 10 months in vaccinees or individuals who acquired the infection naturally; IgG antibody cross-reaction is possibly observed with other flaviviruses. Detection by PCR methods could be valuable for an early differential diagnosis of TBE.

### Management and treatment

There is no specific antiviral therapy for TBE. Treatment relies on supportive management. Meningitis, encephalitis or meningomyelitis require hospitalisation and supportive care based on syndrome severity.

### Key areas of uncertainty

There is a real need for detailed information on the current geographical distribution and spread of tick-borne encephalitis in Europe. Ecological factors possibly linked to the emergence of new foci, should be investigated.



## References

- ECDC fact sheet: [http://ecdc.europa.eu/en/healthtopics/emerging\\_and\\_vector-borne\\_diseases/tick\\_borne\\_diseases/tick\\_borne\\_encephalitis/basic\\_facts/Pages/factsheet-health-professionals.aspx](http://ecdc.europa.eu/en/healthtopics/emerging_and_vector-borne_diseases/tick_borne_diseases/tick_borne_encephalitis/basic_facts/Pages/factsheet-health-professionals.aspx)
- *Ixodes ricinus* [website]. Stockholm: ECDC; 2014 (<http://www.ecdc.europa.eu/en/healthtopics/vectors/ticks/Pages/ixodes-ricinus.aspx>).
- Donoso Mantke O, et al. Tick-borne encephalitis in Europe, 2007 to 2009. *Euro Surveill.* 2011 Sep 29;16(39). pii: 19976.
- Heinz FX, et al. Vaccination and tick-borne encephalitis, central Europe. *Emerg Infect Dis* 2013, 19,1:69-76 (doi: 10.3201/eid1901.120458).
- Kaiser R. The clinical and epidemiological profile of tick-borne encephalitis in southern Germany 1994–98: a prospective study of 656 patients. *Brain.* 1999;122(Pt 11):2067-78.
- Kriz B, et al. Epidemiology of tick-borne encephalitis in the Czech Republic 1970-2008. *Vector Borne Zoonotic Dis.* 2012 Nov;12(11):994-9. doi: 10.1089/vbz.2011.0900.
- Medlock JM et al. Driving forces for changes in geographical distribution of *Ixodes ricinus* ticks in Europe. *Parasites & Vectors.* 2013;6:1.
- Randolph SE. Tick-borne encephalitis incidence in Central and Eastern Europe: multi-factorial environmental and socio-economic causes. *Microbes and Infection* 2008;10:209–216. DOI: 10.1016/j.micinf.2007.12.005.
- Süß J. Tick-borne encephalitis 2010: epidemiology, risk areas, and virus strains in Europe and Asia - an overview. *Ticks and Tick Borne Diseases.* 2011;(1):2-15.