Tick-borne encephalitis

NOTIFIABLE
In England, Wales and Northern Ireland – not currently notifiable in Scotland

The disease

Tick-borne encephalitis (TBE) is an infection of the central nervous system caused by the tick-borne encephalitis virus (TBEV) which belongs to the *Orthoflavivirus* genus (Postler *et al,* 2023). TBE is most frequently transmitted by the bite of an infected *Ixodes* tick and, more rarely, by ingestion of unpasteurized dairy products from infected animals, especially goats (UK Health Security Agency, 2019). TBEV is not directly spread from person to person, although there have been very rare reports of transmission through organ transplants, blood transfusion, via the placenta or through breastfeeding.

Five closely related subtypes of TBEV have been identified with some overlap of geographical distribution (UK Health Security Agency, 2019):

- European (TBEV-Eu) endemic in parts of central, eastern and northern Europe
- Far-Eastern (TBEV-Fe) endemic in far-eastern Russia and parts of China and Japan
- Siberian (TBEV-Sib) endemic in the Urals region, Siberia, far-eastern Russia and some areas in north-eastern Europe
- Baikalian (TBEV-Bkl) found in East Siberia
- Himalayan (TBEV-Him) found in the Qinghai-Tibet Plateau in China

Approximately 25% of infected persons develop clinical symptoms, with most cases being asymptomatic (Lindquist, 2014). The incubation period is usually 7 to 14 days, with a range of 2 to 28 days (Hills *et al*, 2023, Henningsson *et al*, 2016, Lindquist and Vapalahti, 2008). Food-borne TBEV infections tend to have a shorter incubation period with the median time being 3.5 days (Elbaz *et al,* 2022).

Most symptomatic cases with TBEV-Eu experience biphasic disease progression. An initial viraemic phase of fever and influenza-like symptoms is sometimes followed (after an afebrile period of one to 20 days) by central nervous system involvement, including possible meningitis, meningoencephalitis or meningoencephalomyelitis (Lindquist and Vapalahti, 2008). Long term sequelae such as balance disorders, headache and concentration problems are common, with some individuals experiencing serious impairment including paralysis. Outcomes vary depending on age, clinical form and virus subtype. The European subtype has case-fatality rates (CFR) amongst neurologically symptomatic case-patients of less than 2% and long-term neurologic complications in up to 10% of cases. The Siberian subtype has a case-fatality ratio of 6% to 8%, and rare instances of slow or chronic disease progression over several months have been reported; overall CFR in Russia (where Far Eastern and Siberian TBEV predominate) is approximately 2%. The Far Eastern subtype was historically associated with CFR ranging from 20% to 40% but improvements in TBE awareness (and therefore case-ascertainment) and medical care may have reduced this to <10% over recent decades (Hills *et al*, 2023).

History and epidemiology of the disease

The TBE virus was first identified in Russia in 1937 (Dobler and Gneil, 2023). TBE is currently reported from western and northern Europe through to northern and eastern Asia (see https://travelhealthpro.org.uk/ for up-to-date country-specific recommendations).

The preferred habitat for the tick vectors is woodland environments, often favouring the forest edges with low growing vegetation and plant litter (Hills *et al*, 2023). TBEV infected ticks are usually found in discrete, and often small, foci within an area. The virus is maintained in nature by small mammals such as mice, voles, hedgehogs; larger mammals such as deer and domestic livestock and certain species of birds.

Approximately 10,000–12,000 clinical cases of TBE are reported each year globally, but this may be an underestimation (WHO, 2024). The main TBE virus transmission season is from April to November when ticks are most active and feeding although cases are sometimes reported outside these months (European Centre for Disease Control, 2022).

Over the past 30 years, the range of TBE has begun to change in many areas and may continue to spread westward, northward and to higher altitudes (Hills *et al,* 2023). These geographical changes are likely to be due to a complex combination of factors including advances in diagnostics/surveillance, changes in human activities and other socioeconomic, ecologic, land use and climatic factors (Dagostin *et al*, 2023).

Until recently, TBE was considered an imported disease into the UK. TBEV-Eu was first detected in UK ticks in 2019, at the same time as the first probable case of UK-acquired TBE infection in an individual following a tick bite in the New Forest. Since then, a small number of probable and confirmed UK-acquired cases have been diagnosed with infection acquired in different areas across the UK: https://www.gov.uk/guidance/tick-borne-encephalitis-epidemiology-diagnosis-and-prevention#uk-epidemiology.

The Human Animal Infections and Risk Surveillance (HAIRS) group continue to monitor the situation and their current risk assessment for TBE infection for the UK general population is very low. See UKHSA HAIRS risk assessment for further details.

The tick-borne encephalitis vaccination

The TBE vaccine currently available and licensed for use in the UK comes in an adult and child presentation; TicoVac® and TicoVac® Junior. TicoVac® is licensed in the UK for individuals aged 16 years and older. TicoVac® Junior is licensed in the UK for children aged from 1 year to 15 years for protection against TBE.

The vaccine is produced in chick embryo fibroblasts containing the Neudörfl virus strain which is inactivated and adsorbed onto an adjuvant of aluminium hydroxide to improve its immunogenicity. As the vaccine does not contain live organisms, it cannot cause the disease against which it protects.

TicoVac® vaccination induces statistically equivalent titres of TBE virus neutralizing antibodies against European, Siberian and Far Eastern TBE virus strains (Pfizer Ltd, 2021).

Storage

The Green Book, Chapter 3 contains information on vaccine storage, distribution and disposal. Vaccines should be stored in the original packaging at +2°C to +8°C and protected from light. All vaccines are sensitive to some extent to heat and cold. Heat speeds up the decline in potency of most vaccines, thus reducing their shelf life. Effectiveness cannot be guaranteed for vaccines unless they have been stored at the correct temperature. Freezing may cause increased reactogenicity and loss of potency for some vaccines. It can also cause hairline cracks in the container, leading to contamination of the contents.

Presentation

TBE vaccines (TicoVac® 0.5ml and TicVac® Junior 0.25ml) are supplied as a suspension for injection in a pre-filled syringe (type I glass) with a butyl rubber plunger stopper. After shaking the vaccine is an off-white, opalescent suspension.

Dosage and schedule

The primary immunisation schedule is the same for all individuals and consists of three doses of age-appropriate vaccine.

Primary immunisation

Vaccine	Schedule	Rapid Schedule
TicoVac® 0.5ml (Persons 16 years of age and older)	3 doses on days 0, between 1 and 3 months, and 5 to 12 months after the second dose*	2nd dose can be given 2 weeks after the 1st dose. 3rd dose should be given 5 to 12 months after if at ongoing risk.
TicoVac® Junior 0.25ml (Children aged 1 year of age to 15 years of age)	3 doses on days 0, between 1 and 3 months and 5 to 12 months after the second dose*	2nd dose can be given 2 weeks after the 1st dose. 3rd dose should be given 5 to 12 months after if at ongoing risk.

*After the first two doses, sufficient protection can be expected for the on-going tick season (protection rate over 90 percent after the second dose).

The best time to start a course of TBE vaccination, if at risk and travelling to areas where vaccination is recommended, is during the winter to ensure protection before the tick season starts in spring. Maximal protection (over 98%) follows the third dose, however the full three-dose primary schedule with these intervals is commonly not feasible as a pre-travel regimen. Over 90% protection is seen after the first two doses of a standard regimen. For rapid short-term protection of children and adults the second dose may be given two weeks after the first dose and gives around 90% protection 14 days after the second dose (Pfizer Ltd, 2021a/b, Pugh *et al*, 2022).

Reinforcing immunisation

Vaccine	Length of protection
TicoVac® 0.5ml (Persons 16 years to 59 years)	First booster 3 years after 3rd dose. After this, boosters may be given at 5-year intervals if at continued risk
TicoVac® 0.5ml (Persons 60 years and older)	First booster 3 years after 3rd dose. Subsequent boosters should not exceed 3-year intervals if at continued risk
TicoVac® Junior 0.25ml (Children aged 1 year of age to 15 years of age)	First booster 3 years after 3rd dose. After this, boosters may be given at 5-year intervals if at continued risk

Protection has been shown to wane after vaccination and particularly in older groups (>60 years). Subsequent booster vaccines should be considered every 5 years for those under 60 years old and every 3 years for those aged 60 and over with continued risk to TBE (Miazga *et al*, 2023).

For those previously vaccinated and travelling again to a risk area, booster vaccination should be considered based on the interval since their third primary dose (or most recent booster, if applicable). A person who previously had two of the three primary doses (standard or rapid) and is again travelling to a risk area beyond the 5 to 12 month recommended interval for a third dose should be given a single dose to complete the primary schedule.

Administration

The Green Book, Chapter 4: Immunisation procedures covers guidance on administering vaccines. TicoVac® and TicoVac® Junior should be given by intramuscular injection. However, for individuals who have a bleeding disorder, should be given by deep subcutaneous injection to reduce the risk of bleeding. TBE vaccines can be given at the same time as other travel or routine vaccines. The vaccines should be given at a separate site, preferably in a different limb. If given in the same limb, they should be given at least 2.5cm apart (American Academy of Pediatrics, 2025).

Disposal

The Green Book, Chapter 3: contains information on vaccine storage, distribution and disposal. Equipment used for vaccination, including used vials, ampoules, or partially discharged vaccines should be disposed of at the end of a session by sealing in a proper, puncture-resistant ‘sharps’ box according to local authority regulations and guidance in Health Technical Memorandum 07-01: Safe management of healthcare waste (Department of Health, 2023).

Recommendations for use of the vaccine

TBE vaccination is used for the protection of individuals at high risk of exposure living in or travelling to endemic areas or who are at occupational risk. Guidance on the

employer's responsibility under Control of Substances Hazardous to Health (COSHH) Regulations is described in the Green Book: Immunisation of healthcare and laboratory staff.

TBE vaccine is recommended for those who are travelling outside the UK and intend to visit or reside in an area where TBE is endemic, particularly those who plan to work in forestry, farming and the military and those engaged in recreational activities with increased likelihood of exposure to ticks, for example camping and hiking.

In the UK, there is minimal risk of TBE infection in those with employment or recreational exposure to ticks, even in areas where the infection has been found to be present in ticks. However, since the consequence of infection can be significant and there is a protective vaccine available, vaccination should be considered in people with ongoing and regular exposure to ticks in regions where ticks infected with TBEV have been found. At the time of writing, these areas include the New Forest, Thetford Forest, the Hampshire and Dorset border and North Yorkshire Moors but updates can be found on the UKHSA web page: https://www.gov.uk/guidance/tick-borne-encephalitis-epidemiology-diagnosis-and-prevention#uk-epidemiology.

Occupational groups at risk include forestry workers, deer cullers, and field scientists. Refer to UKHSA HAIRS risk assessment for further details.

Vaccine can be considered for:

Travellers and those going to reside abroad

All travellers should undergo a careful risk assessment that takes into consideration their itinerary, season of travel, duration of stay and planned activities. Detailed country-by-country information is available at https://travelhealthpro.org.uk/. Awareness of risk areas is essential, and all travellers should take steps to avoid tick bites regardless of whether vaccine is given.

Laboratory workers

Immunisation is recommended for all research laboratory staff who have potential exposure to the virus. Infection has followed laboratory sharps injuries (UKHSA, 2019).

Contraindications

There are few individuals who cannot receive TBE vaccine. When there is doubt, appropriate expert advice should be sought.

The TBE vaccine should not be given to those who have had:

- a confirmed anaphylactic reaction to a previous dose of TBE vaccine
- a confirmed anaphylactic reaction to one of the vaccine components (cross-allergies with aminoglycosides should be considered)

The TBE vaccine is grown on primary chick embryo cells. The amount of ovalbumin that may be present is ≤0.5 ng/dose. Thus, the risk posed to egg-allergic individuals is considered to be negligible, and similar to that for MMRV for which no precautions are recommended. Therefore, JCVI have advised that egg allergy (including a history of anaphylaxis to egg) is no longer considered a contra-indication.

Precautions

Minor illnesses without fever or systemic upset are not valid reasons to postpone immunisation. If an individual is acutely unwell, immunisation may be postponed until they have recovered fully. This is to avoid confusing the differential diagnosis of any acute illness by wrongly attributing any signs or symptoms to the adverse effects of the vaccine.

The manufacturer advises risk benefit needs to be considered for those with:

- known or suspected auto-immune disease
- pre-existing cerebral disorders such as active demyelinating disorders or poorly controlled epilepsy

Pregnancy and breast-feeding

TBE vaccines may be given to pregnant or lactating women when clinically indicated. There is no evidence of risk from vaccinating pregnant women or those who are breast feeding with inactivated vaccines (Freedman and Kroger, 2023).

Adverse reactions

The most common adverse reactions observed after TicoVac® administration are pain and tenderness at the injection site, pyrexia, headache, nausea, fatigue, arthralgia and myalgia. Fevers occurred more frequently in younger than in older children. Fever rates after the second and third vaccinations are generally lower than after the first vaccination (Pfizer Ltd, 2021b).

A systematic review found that European vaccines, including TicoVac® were well tolerated in children and adults. Local injection site reactions were reported in 24.8% (4.3–54%) and systematic reactions in 30% (0.6–45.9%) of vaccinees. Vaccine related serious adverse events (SAEs) were rare (Rampa *et al*, 2020).

Serious suspected adverse reactions to all vaccines should also be reported through the MHRA Yellow Card scheme.

Management of cases and exposures to ticks

Ticks should be removed as soon as possible using fine tipped tweezers or a tick removal tool, and the site cleaned with soap and water. See UKHSA Tick awareness and toolkit for further resources. Fever or flu-like symptoms following a tick bite should be investigated and where appropriate individuals should be referred to a hospital to be seen by an infection specialist.

Diagnostic testing is performed by the UKHSA Rare and imported pathogens laboratory (RIPL). In patients who have developed neurological symptoms, TBEV IgM and/or IgG antibodies are usually detectable in serum, except in those who are immunocompromised. For this reason, serum should be submitted in the first instance. RIPL will then request cerebrospinal fluid (CSF) if further analysis is required. If TBE is suspected, the referring clinician should contact the Imported Fever Service. https://www.gov.uk/guidance/imported-fever-service-ifs.

Post exposure vaccination following a tick bite is not recommended (Taba P *et al*, WHO, 2011). This is based on the assumption that vaccination after a tick bite is unlikely to induce immunity before possible onset of disease, together with the theoretical risk of antibody-dependent enhancement in unvaccinated patients (WHO, 2011).

In western Europe, the use of specific immunoglobulin for passive post exposure prophylaxis was found to have no beneficial effect. This approach is no longer recommended in western Europe but is sometimes used in the Russian Federation (WHO, 2011).

There is no specific drug or antiviral treatment for TBE, but supportive treatment can significantly reduce morbidity and mortality. Suspected cases of TBE should be referred to infectious disease centres. Long-term support for neurological complications may be needed.

Supplies

TicoVac® and TicoVac® Junior are available from Pfizer Ltd https://www.pfizer.co.uk/ (01304 616161).

References

American Academy of Pediatrics (2025). 7 Rights of Vaccine Administration. Last Updated 7 March 2025 https://www.aap.org/en/patient-care/immunizations/implementing-immunization-administration-in-your-practice/vaccine-administration/

Dagostin, F. *et a*l (2023). Ecological and environmental factors affecting the risk of tick-borne encephalitis in Europe, 2017 to 2021. *Euro Surveill*. 2023; 28 (42) DOI: https://doi.org/10.2807/1560-7917.ES.2023.28.42.2300121

Department of Health (2023). Health Technical Memorandum 07-01: Safe and sustainable management of healthcare waste. Last updated 26 January 2024. https://www.england.nhs.uk/publication/management-and-disposal-of-healthcare-waste-htm-07-01

Dobler, G., Gniel, D. (2023). A History of Tick-Borne Encephalitis and Its Virus. In: Vasilakis, N., Kramer, L.D. (eds) History of Arbovirology: Memories from the Field. Springer, Cham. DOI: https://doi.org/10.1007/978-3-031-22003-6_21

Elbaz, M., Gadoth, A., Shepshelovich, D., Shasha, D., Rudoler, N., & Paran, Y. (2022). Systematic Review and Meta-analysis of Foodborne Tick-Borne Encephalitis, Europe, 1980–2021. *Emerging Infectious Diseases*, 28 (10), 1945-1954. DOI: https://doi.org/10.3201/eid2810.220498

European Centre for Disease Prevention and Control (2022). Tick-Borne Encephalitis. In Annual Epidemiological Report for 2020; ECDC: Stockholm, Sweden. https://www.ecdc.europa.eu/en/publications-data/tick-borne-encephalitis-annual-epidemiological-report-2020

Henningsson, A. J., Lindqvist, R., Norberg, P., Lindblom, P., Roth, A., Forsberg, P., Lindgren, P. (2016). Human Tick-Borne Encephalitis and Characterization of Virus from Biting Tick. *Emerging Infectious Diseases*, 22 (8), 1485-1487. DOI: https://doi.org/10.3201/eid2208.151962

Hills, S.L, Poehling, K.A., Chen, W.H. *et al* (2023). Tick-Borne Encephalitis Vaccine: Recommendations of the Advisory Committee on Immunization Practices, United States, *MMWR Recomm Rep*, 2023; 72(No. RR-5): 1–29. DOI: http://dx.doi.org/10.15585/mmwr.rr7205a1

Lindquist, L and Vapalahti, O. (2008). Tick-Borne encephalitis. *The Lancet* Volume 371, Issue 9627 p1861-1871 DOI: 10.1016/S0140-6736(08)60800-4

Lindquist L. (2014) Tick-borne encephalitis. *Handb Clin Neurol*. 123: 531–55. DOI: https://doi.org/10.1016/b978-0-444-53488-0.00025-0

Miazga, W., Wnuk, K., Tatara, T. *et al.* (2023). The long-term efficacy of tick-borne encephalitis vaccines available in Europe - a systematic review. *BMC Infect Dis* **23**, 621 DOI: https://doi.org/10.1186/s12879-023-08562-9

Freedman M.S. and Kroger A. T. (2023). Chapter 10, General Immunisation Practices. In: Orenstein W, Offit P, Edwards KM and Plotkin S (eds). Plotkin's Vaccines (Eighth Edition) Elsevier. DOI: https://doi.org/10.1016/B978-0-323-79058-1.00010-4

Pfizer Ltd (2021a) TicoVac 0.5 ml Suspension for injection in a prefilled syringe - Summary of Product Characteristics (SmPC) Date of revision of the text: 08/2021 Accessed July 2026

Pfizer Ltd (2021b) TicoVac Junior 0.25 ml Suspension for injection in a pre-filled syringe - Summary of Product Characteristics (SmPC)
Date of revision of the text: 08/2021. Accessed July 2026

Postler T.S, Beer M, Blitvich B.J. *et al* (2023). "Renaming of the genus *Flavivirus* to *Orthoflavivirus* and extension of binomial species names within the family *Flaviviridae*". *Arch Virol*. **168** (9): 224. DOI: https://doi.org/10.1007/s00705-023-05835-1

Pugh, S.J., Moïsi, J.C; Kundi, M *et al* (2022). Effectiveness of two doses of tick-borne encephalitis (TBE) vaccine, *J Travel Med*, 29 (2). DOI: https://doi.org/10.1093/jtm/taab193

Rampa, J.E., Askling, H.H, Lang, P. *et al*. (2020). Immunogenicity and safety of the tick-borne encephalitis vaccination (2009–2019): A systematic review. *Travel Medicine and Infectious Disease*. Volume 37. DOI: https://doi.org/10.1016/j.tmaid.2020.101876

UK Health Security Agency (2019). Tick-borne encephalitis: epidemiology, diagnosis and prevention. https://www.gov.uk/guidance/tick-borne-encephalitis-epidemiology-diagnosis-and-prevention Updated 21 May 2026

UK Health Security Agency (2023). HAIRS risk assessment: tick-borne encephalitis. https://www.gov.uk/government/publications/hairs-risk-assessment-tick-borne-encephalitis/hairs-risk-assessment-tick-borne-encephalitis Updated 5 April 2023

UK Health Security Agency (2025). Tick awareness and toolkit. https://www.gov.uk/guidance/tick-awareness-and-toolkit Updated 6 March 2025

Taba, P., Schmutzhard, P., Forsberg, P. *et al*. (2017). EAN consensus review on prevention, diagnosis and management of tick-borne encephalitis. European Journal of Neurology, Volume 24 (10). DOI: https://doi.org/10.1111/ene.13356

World Health Organization (2024). Tick-borne encephalitis: Tick-borne encephalitis

World Health Organization. (2011). Vaccines against tick-borne encephalitis: WHO position paper. WER No. 24 https://www.who.int/publications/i/item/who-wer-8624-241-256