

Epidemiology 2006

# Tick-Borne Encephalitis (TBE, FSME)



*“TBE is endemic to most European countries, the Russian Federation and possibly China. It is the most important arthropod-transmitted viral disease in Europe, and in some countries it represents a major public health problem. Large outbreaks of TBE, sometimes involving thousands of cases, continue to occur in endemic areas.”*

WHO: [http://www.who.int/entity/biologicals/areas/vaccines/tick\\_encephalitis/en/](http://www.who.int/entity/biologicals/areas/vaccines/tick_encephalitis/en/)

## Introduction

Over the past decades, tick-borne encephalitis (TBE) has become a growing public health concern in Europe and other parts of the world. Table 1 summarizes the number of TBE infections in those European countries where the disease poses a major threat to public health. In many of these countries, morbidity has been on the increase for years.

TBE is a notifiable disease in many European countries, such as Austria, the Czech Republic, Finland, Germany, Hungary, Latvia, Lithuania, Poland, Slovenia, Slovakia, Sweden, and Switzerland. In highly endemic areas where the majority of the population is vaccinated against TBE, as is the case for Austria, the number of reported cases of TBE does not adequately reflect the actual risk of infection.

The epidemiology of TBE is very complex. The geographical focus of the TBE virus is on central

Europe, the Baltic States, and the Russian Federation. There are also low-risk areas, such as in Finland, Germany, Sweden, Norway, and Switzerland, with a trend towards both an expansion of risk areas and an increase in incidence. New foci have been found to emerge in Sweden and Norway. Denmark, particularly the island of Bornholm, is a good example of a risk area that may have been forgotten for some time but has now been rediscovered.<sup>1)</sup>

The endemic map on pages 10 and 11 shows the regions in Europe and Asia where TBE infection has occurred. Information on TBE is collected by the International Scientific Working Group On Tick-Borne Encephalitis (ISW-TBE), a group comprised of internationally recognized scientific experts from endemic countries with extensive personal expertise in the field of TBE and a high level of commitment to raising awareness of this potentially devastating disease.<sup>2)</sup>

## Epidemiology of TBE



► **Austria:** Before the annual TBE vaccination campaign was introduced in 1981, Austria had the highest recorded morbidity of TBE in Europe, with up to 700 hospitalized cases per year. The increase in vaccination coverage since 1981 to more than 85% has led to a steady decline in TBE. In the 5-year period between 2001 and 2005, a mean of 61 cases were reported annually, equaling an incidence rate of 0.8 per 100000 population. The regions most affected by TBE are Styria, Carinthia, Upper Austria,

the south of Vienna, and parts of Burgenland. In 2003, new endemic areas were described in the region around Mattsee, Wallersee, and Thal-gau north of the city of Salzburg. For an unvaccinated tourist staying in a highly endemic province of southern Austria, such as Styria, the risk of acquiring TBE has been estimated at 1 to 10000 person-months of exposure. Based on the number of tourist overnight stays in Austria during the summer, about 60 travel-associated cases of clinical TBE can be expected to occur among visitors to Austria.<sup>3)</sup>

Number of reported cases of TBE from various European countries and Russia:

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006*
Albania	8																
Austria	89	128	84	102	178	109	128	99	62	41	60	54	60	82	54	100	84
Belarus			2	20	50	66	97	67	78	26	23	61	18	25			
Croatia	23	60	27	76	87	59	57	25	24	26	18	27	30				20
Czech R.	193	356	338	629	613	744	571	415	422	490	719	411	647	606	500	642	1.113**
Denmark									1	4	3	1	1	4	8	4	
Estonia	37	68	163	166	177	175	177	404	387	185	272	215	90	237	182	164	171
Finland	9		14	25	16	23	10	19	17	12	41	33	38	16	31	17	18
France	2	1	2	5	4	6	1	1	2	5	0	0	2	6	7	0	
Germany		44	142	118	306	226	114	211	148	115	133	253	226	278	274	431	547**
Hungary	222	288	206	329	258	234	224	99	84	51	45	76	80	114	59	90	115
Italy			2	2	8	6	8	8	11	5	15	19	6	14	23	22	14**
Latvia	122	227	287	791	1.366	1.341	716	874	1.029	350	544	303	153	365	251	142	171
Lithuania	9	14	17	198	284	426	309	645	548	171	419	298	168	763	425	242	462
Norway									1	1	2	1	2	1	3	0	5
Poland	8	4	8	249	181	267	257	201	209	101	170	205	126	339	262	174	316**
Russia	5.486	5.225	6.301	7.893	5.593	5.982	9.548	6.539	6.987	9.955	5.931	6.339	5.150	4.770	4.235	4.551	3.510**
Slovak R.	14	24	16	51	60	89	101	76	54	57	92	76	62	74	70	28	
Slovenia	235	245	210	194	492	260	406	274	136	150	190	260	262	275	204	297	372**
Sweden	54	75	83	51	116	68	44	76	64	53	133	128	105	105	160	130	163
Switzerland	26	37	66	44	97	60	62	123	68	112	91	107	53	116	138	206	259
Ukraine													12				

\* Registrations not completed

\*\*preliminary data



► **Germany:** The map of TBE risk areas is updated periodically by the Robert Koch Institute. Since 1992, between 100 to 300 autochthonous clinical TBE cases were recorded annually. An all-time high was reached in 2005, when 431 cases were reported – an increase by 58% compared to 2004. This was overshadowed by an additional 27% increase in 2006, with preliminary figures pointing to approx. 550 cases. These occurred mainly in southern Germany, i.e., in the federal states of Baden-Wuerttemberg (42%) and Bavaria (38%).<sup>4)</sup> There are high-risk areas in Bavaria and Baden-Wuerttemberg and ongoing low-risk areas in Hesse, the entire Odenwald region, and Thuringia. Between 1994 and 2005, more than 50 single cases were reported from areas previously not defined as risk areas, i.e., in Saxony, Lower Saxony, Mecklenburg-Western Pommerania, Saxony-Anhalt, and Brandenburg.<sup>1)</sup>

Whereas the incidence of TBE in Bavaria and Baden-Wuerttemberg has remained stable on a high level for years, increasing incidences have been reported in other areas of Germany, such as Odenwald and Thuringia.<sup>1)</sup> Ninety-six of the 440 German counties are currently classified as TBE risk areas. These are located in Bavaria (55), Baden-Wuerttemberg (32), Hesse (5), Thuringia (3), and Rhineland-Palatinate (1). A total of 9 of these areas are considered high-risk areas. An additional five counties in Baden-Wuerttemberg are classified as endemic for TBE based on seroprevalence studies.<sup>1)</sup>



► **Switzerland, Liechtenstein:** In the 5-year period between 2000 and 2004, a mean of 101 cases were reported annually. In 2005 and 2006, 207 and 259 cases were reported, the highest in recorded history in Switzerland. There are two high-risk regions, the larger one covering the midland, with the exception of the far-western part, and the smaller one located in

the upper Rhine valley, including the principality of Liechtenstein. A focus of ticks infected with the TBE virus (TBEV) is located on a much-used forest path near Vaduz, the capital of the principality.<sup>5)</sup> The canton Zürich has become the most dangerous region for TBE in Switzerland,<sup>6)</sup> followed by Thurgau, St. Gallen, Aargau, and Bern.



► **France:** Some cases have been reported from the Alsace region, and single cases of infections are documented from the region Nancy, Lothringen. New cases were recently reported from Faverges and Grenoble.<sup>7)</sup>



► **Italy:** A few clinical cases have been recorded in Northern Italy in the area of Florence, Trento, and Belluno. In 2006, first cases were reported in Friuli Venezia Giulia. Anti-TBEV antibodies have been found in about 1% of persons at potential risk, such as foresters, hunters, woodcutters, and gamekeepers.<sup>8)</sup> Since the early 1990s, between 2 and 19 cases were reported annually, with 23 cases in 2004. In 2006, one reported TBE case took a lethal course.



► **Denmark:** The island of Bornholm has long been known for being a TBE risk area. In the 7-year period between 1994 and 2000, a total of 14 cases of TBE were reported, equaling an incidence rate of 3.81 per 100000 inhabitants.<sup>9)</sup> Four cases were notified in the year 2003. The minimum level of prevalence of TBEV in ticks on Bornholm is similar to what has been found in other European countries where TBEV is endemic. In Denmark, TBEV and the Louping ill flavivirus have been found to coexist in *Ixodes ricinus*.<sup>10)</sup>



► **Sweden:** Since the end of the 1990s, around 100 cases have been reported annually. In the 5-year period between 2000 and

2004, the average was 127 annual cases. Occurrence has been highest in 2006, with 163 reported cases. Most of the infections were acquired in the counties of Stockholm (62%), Södermanland (13%), and Uppsala (8%). In the county of Västra Götaland south of Lake Vänern, 5 to 10 cases are notified annually. Sporadic cases occur in the rest of Sweden every year.



► **Norway:** In Norway, TBE was first reported in 1997. All 17 cases were acquired within a limited area along the southern coast, and 4 cases were diagnosed in the municipality of Tromøy. A study done among regular patients attending a health center in Tromøy showed a anti-TBEV antibody seroprevalence of 2.4%.<sup>11, 12</sup> In previous studies, IgG antibodies to TBEV had been found in 0.3% to 0.4% of persons from different parts of Agder county, a region where TBE had previously not been seen.<sup>13</sup>



► **Finland:** Between 2000 and 2004, an average of 32 annual cases were reported, with a record number of 41 cases in 2000.<sup>14</sup> The known endemic areas are situated mainly in Åland (66% of 125 cases reported between 1987 to 1997, 80 per 100000 population in 2000), on the archipelago of Turku (10%), and in the Krokola (6%) and Lappeenranta regions (5%). Anti-TBEV antibody analyses suggest that one in five Ålanders is infected during his or her lifetime. Recently, 9 cases were identified on an island close to the city of Helsinki.<sup>15</sup>



► **Lithuania:** TBE is present in all districts of Lithuania.<sup>14</sup> In 2003, the epidemiology of TBE in Lithuania was very unusual. The incidence rate (763 cases, 22 per 100000 population) was double the average incidence over the last ten years, and was the highest annual rate

recorded since notification began at the end of the 1960s. This rate was also the highest of all the Baltic countries in 2003. Four lethal cases of TBE were notified in 2003. In 2004, a total of 425 hospitalized cases were reported.<sup>16</sup> Even though normally transmitted through a tick bite, 22 cases of TBE in 2003 (four clusters) were acquired by consuming unpasteurized goat milk – a well-known transmission route. The highest annual incidences of TBE, about 80% of all notified cases, are recorded in the northern and central parts of the country, i.e., mainly in the counties Kaunas, Panevezys, and Siauliai. In 2003, the incidence rates in these areas remained unchanged but were much higher in many other counties. Eight of 44 districts reported a two to five times higher incidence rate than the average incidence in Lithuania. The highest incidence rate was recorded in Panevezys, with about 100 per 100000 population.<sup>16</sup> Preliminary data for the year 2006 show more than 462 registered cases.



► **Latvia:** Latvia is considered the country with the highest TBE incidence rates in the world. TBE cases have even been reported in and around the city park of Riga. Ticks in Latvia carry a higher TBEV load than ticks in other risk countries. In 1993, annual incidence quadrupled compared to the mean level of the previous two decades (nearly 8 cases per 100000 population), reaching the highest levels in 1994 and 1995 at 53 cases per 100000. Since 1999, the incidence has been significantly lower, down to 6.5 cases in 2002, but back up to 15.7 per 100000 in 2003.<sup>17</sup> Food-borne outbreaks (caused by dairy products, mainly goat milk) accounted for up to 5% of total annual cases.



► **Estonia:** In the 10-year period between 1997 and 2006, 230 annual cases were registered in Estonia. The highest TBE distribution rates are seen in western Estonia (Pärnum-

aa, Läänemaa), eastern Estonia (Ida-Virumaa), on Saaremaa (island in the west), and in south-eastern Estonia (Põlvamaa, Tartumaa).<sup>18)</sup>



► **Poland:** Since 1993, the number of reported cases at country level has ranged from 100 to 350 cases per year. In 2003, the number of reported cases was 339 (0.89 per 100000). The north-east of the country around Białystok is the main area of endemicity.<sup>19)</sup> 80% of cases occurred in the two north-eastern provinces adjacent to Lithuania and Belarus. Another important focus of the disease is in the south-western part of Poland, in districts adjacent to the Czech Republic.



► **Ukraine:** The TBE foci are located throughout the entire mountain forest zone of the Crimea and coincide with the habitat area of *I. ricinus*, the main vector of TBE.<sup>20)</sup> Between 1980 and 1990, about 100 patients with TBE were recorded in the Crimea, where co-infections with TBE and Crimean-Congo hemorrhagic fever have been found.<sup>21)</sup>



► **Moldavia:** Although reliable data is missing, it is assumed that TBE is present.



► **Romania:** Risk of tick-borne encephalitis is reported for the Tulcea district and in Transylvania at the base of the Carpathian Mountains and the Transylvanian Alps.<sup>22)</sup> However, details about the annual numbers of TBE cases have not been published.



► **Slovakia:** In the past 10 years, the number of reported cases at country level has ranged from 54 to 101 cases annually. In 2002, the number of reported cases was 62 (1.15 per 100000), and in 2003 it was 74 (1.38 per

100000). Some of the reported cases were caused by drinking raw goat and sheep milk from home production. New foci have been identified in areas of eastern Slovakia traditionally thought to be free of the virus.<sup>23)</sup>



► **Czech Republic:** TBE exists in all parts of the country. Between 2000 and 2004, an average of 577 cases of TBE occurred annually. Thus, the Czech Republic is second only to Russia in terms of TBE incidence. The incidence is higher in regions south of Prague near the city of Ceske Budejovice. There has been a constantly high incidence near the town of Pilsen in the western part of the country. Recently, TBE foci have been identified in the northern part of the province of Bohemia. In the east of the country, there has been a high incidence near Olomouc. Clinical cases of TBE are notified from April until November every year, with a peak in July. In 2005, 642 cases were reported. Preliminary data on the year 2006 suggest the highest number of TBE cases registered since notification began, i.e., around 1113.<sup>24)</sup>



► **Hungary:** The average yearly incidence rate between 1977 and 1996 was 2.5 per 100000 population (range 1.3 to 3.8), with the highest incidences between 1981 and 1990. From 1997 to 2000, a significant decrease in the number of registered TBE cases was observed, with an incidence rate of 0.5 per 100000 in 2000. Since 2001, the incidence has increased again. Between 2000 and 2003, an average of 79 cases were reported annually. Extended areas of high risk are located in western Hungary and along the Danube region, i.e., the counties of Zala, Somogy, and Vas (western Hungary), Nógrád (northern Hungary), and around Lake Balaton.



► **Slovenia:** Endemic foci of TBE are spread all over the country. Between 2001 and 2003, the 3-year average was 265 cases. The

highest number of TBE cases had been reported in 1994, with a total of 492 cases.



► **Croatia:** Only one natural focus in the northern part of the country is described, i.e., between the rivers Sava and Drava. During the

past 10 years, the number of annual cases has ranged from 18 to 38.<sup>7)</sup>



► **Bosnia:** Even though there may be some cases in the northern parts of the country, details have not been published.<sup>7)</sup>



► **Serbia:** A few cases have been reported in the area near Belgrade, including food-borne outbreaks near the coastal regions of

the Adria, but there is no published information available on these cases.



► **Albania:** Natural foci are found throughout Albania. Older publications show a TBEV prevalence of 22%. Alimentary cases of TBE

have also been reported. Before 1990, 25 new cases were registered every year. Since then, no data have been published.<sup>7)</sup>

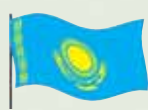


► **Greece:** Single cases have been reported in the north of the country, i.e., Thessaloniki.



► **Belarus:** About 20 to 80 cases of TBE occur annually, with a peak of 97 cases in 1996. Even though Belarus is believed to be a country with

high-risk areas and a high TBEV prevalence in ticks, information on clinical cases is scarce. In 2003, 25 clinical cases were reported in the area of Minsk.



► **Kazakhstan:** Cases of TBE are supposed to have occurred, but there is a lack of specific reported information.



► **Russia:** TBE is endemic from Kaliningrad to Wladiwostok. In 1996, the TBE morbidity rate increased dramatically from 6000

to 10000 persons per year. The highest morbidity rate is registered in the Ural, Perm, and Sverdlovsk regions (13.4 per 100000 of population; Udmurt Republic: 53.5 per 100000; West Siberia, Tomsk region: 72.5 per 100000; East Siberia, Krasnoyarsky Krai: 37 per 100000).

The most dangerous foci of TBE have been found to be located in the southern Okhotsk region with its dark coniferous forests<sup>25)</sup> and in the Sikhote-Alin mountain range near Vladivostok.<sup>26)</sup> In the Primorye region (far-eastern part of Russia along the coast of the Sea of Japan), 126 people were hospitalized with a diagnosis of TBE between January and August 2004, 17 of whom were children. A total of 8 fatalities were reported. Between 1996 and 1999, the number of TBE patients in the Lake Baikal region ranged from 460 to 780 cases per year and has shown a trend towards an increase. The relative index per 100000 population ranged from 2.6 to 18.1.<sup>27)</sup>

The Sverdlovsk region has long been known as a natural nidus of tick-borne encephalitis. The majority of cases have been reported in Yekaterinburg, with an increase in 2003 compared to 2002. Other foci are in Nizhni Tagil, Kamensk-Uralsky, Verkhnyaya Pyshma, Nizhnyaya Tura, Nevyansk, and Sukhoy Lo. The main vector of TBEV in the Asian and European parts of Russia is *I. persulcatus*. Lethal TBE outcomes have been registered in Siberia (Irkutsk region and Krasnoyarsk territory) and in the European parts of Russia (Yaroslavl region).<sup>28)</sup>



► **Mongolia:** In 2004, some endemic areas were described next to the Russian border in the north of the country (provinces of Selenga and Bulgan) and around the capital city Ulan-Bataar.



► **China:** Data on TBE morbidity is scarce. Natural foci are the Hun-chun area, Jilin province, and in the subtropical region of western Yunnan near the Burmese border.<sup>7)</sup>



► **Japan:** In 1993, a case of TBE was reported in the southern part of Hokkaido. Since 1995, the TBE virus has been isolated from the blood samples of sentinel dogs, tick pools, and rodent spleens. A seroepidemiological survey performed among humans and animals showed that the TBE virus may be endemic in Japan, at least on the island of Hokkaido.<sup>29)</sup> The main vector on Hokkaido was identified as *I. ovatus*, and genomic sequence and phylogenetic analyses of a virus isolate showed a close relationship with the Far-Eastern subtype of the TBE virus.

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## Epidemiological map – 2006

The map is based on local reports and publications of documented cases of TBE virus infection, screening for anti-TBEV antibodies in healthy unvaccinated populations, and regional screening for the TBE virus in ticks and hosts.

Epidemiological information has been reported per district or region, e.g., Russia, Slovakia, the Czech Republic, the Baltics, and Germany. Maps showing the locations where infection has

occurred have been collected for Austria, Switzerland, Sweden, and Denmark.

The extent of epidemiological assessment of TBE varies between countries. The data presented here may therefore not be complete. Also, it cannot be excluded that TBE viral infection with subsequent development of the disease will occur in new areas.

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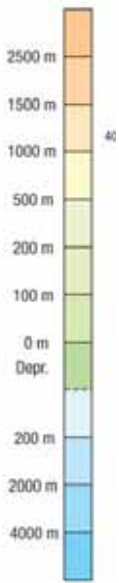
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# TBE/FSME\* in Europe 2006

\*Ttick-borne Encephalitis/Frühsummer-Meningoencephalitis







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