



Tick-borne encephalitis surveillance systems and vaccination recommendations in UE/EEA, 2009

Collaboration between VENICE II project and ECDC

VENICE II

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Abbreviations

ECDC	European Centre for Disease Prevention and Control
EEA	European Economic Area
EU	European Union
MSs	Member States
TBE	Tick-borne encephalitis
VENICE	Vaccine European New Integrated Collaboration Effort

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ISO 3166-1 Country Codes

AT	Austria
BE	Belgium
BG	Bulgaria
CY	Cyprus
CZ	Czech Republic
DK	Denmark
EE	Estonia
FI	Finland
FR	France
DE	Germany
GR	Greece
HU	Hungary
IS	Iceland
IE	Ireland
IT	Italy
LV	Latvia
LT	Lithuania
LU	Luxembourg
MT	Malta
NL	The Netherlands
NO	Norway
PL	Poland
PT	Portugal
RO	Romania
SK	Slovakia
SI	Slovenia
ES	Spain
SE	Sweden
UK	United Kingdom

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Background

Tick-borne encephalitis (TBE) is an acute disease of the central nervous system caused by a virus from the *Flaviviridae* family. The infection, caused by one of the subtypes of TBE virus circulating in Europe, usually progresses biphasically. The first (viremic) phase often is asymptomatic or cause influenza like symptoms. Only about one third of cases progress to the second phase. The disease may present as meningitis, encephalitis, meningoencephalitis, meningoencephalomyelitis or can cause other clinical syndromes. Sequelae are reported in 35-58% of patients [1].

There is no curative treatment for TBE. The only successful method of prevention is active immunization. The first vaccine against TBE was produced in 1937. It was the first vaccine against Flavivirus and the third vaccine against viruses in the world [2]. In Europe two highly effective and safe vaccines are used in preventing TBE infection and its chronic consequences. They typically need three doses of primary immunization at 0-1-6 months, and booster doses every 3-5 years.

In spite of presence of effective vaccine, the TBE is growing a public health problem in Central and Northern Europe. From 1974 to 2003 a 400% increase was observed in TBE morbidity in Europe. Each year about 3000 clinical cases are reported in Europe [3].

An increase of morbidity and incidence of TBE has been detected in Europe during the last decade. The vaccination strategies against tick-borne encephalitis differ among European countries. It is mostly related to highly focal TBE occurrence. Currently there is no comprehensive information on how TBE vaccination programmes are organized in particular countries, and how the information on the disease is collected.

Hence, a need was recognized to collect information on TBE surveillance, and recommendations for local population and tourists. Especially, the knowledge of the modalities of ascertainment of high-risk areas in Europe and dissemination of information, is necessary for the development of European recommendations for tourists and local population. Considering that TBE is a potentially food-borne disease, standardized surveillance data collected in European countries, and standardized definition of high-risk areas, would greatly improve the development of appropriate recommendations and eventual interventions.

VENICE II Project has been asked by the European Centre for Disease Prevention and Control (ECDC) to survey the VENICE network members states regarding TBE surveillance and TBE vaccination recommendations in their own countries.

Aim of the study and specific objectives

The aim of the study was to evaluate TBE vaccination strategies and outline localization and modalities of ascertainment of TBE endemic areas in the EU/EFTA countries.

The specific objectives of the study were:

- Assess TBE incidence data available in countries,
- Characterize surveillance systems for TBE in particular countries,
- Describe existing information on TBE endemic areas, and methods of their ascertainment;
- Summarize vaccination recommendations in particular countries;
- Summarize methods used for immunization coverage assessment.

Methods and materials

Study design

A cross-sectional survey was undertaken. This survey was a collaborative study between the European Centre for Disease Prevention and Control (ECDC), VENICE Project and European Union (EU) and European Economic Area (EEA) Members States (MS).

Currently 27 EU and two EEA (Norway and Iceland) countries participate in the VENICE project (http://venice.cineca.org/participating_countries.html). A gatekeeper was previously identified for each member state; the gatekeepers are responsible for conducting all VENICE surveys inside their countries.

A contact point was sometime identified for the TBE survey: some gatekeepers filled the survey themselves; other gatekeepers delegated another expert as contact point for this specific survey.

Data collection

A standardized questionnaire was developed using close-ended questions predominantly. Information concerned surveillance of TBE, ascertainment of endemic areas, vaccination recommendations, vaccination coverage, payment and administration costs for vaccine, vaccination recommendations for tourist going abroad (appendix 1).

The questionnaire was developed by the Polish partner, representing the leading partner for TBE activity, and later shared with the other members of the VENICE II Consortium for comments: the Italian Istituto Superiore di Sanità (ISS), the French Institut de Veille Sanitaire (InVS) and the Irish Health Protection Surveillance Centre (HPSC).

Data handling

The electronic questionnaire was developed on the VENICE website (<http://venice.cineca.org>) by CINECA (the technical partner of the VENICE II Consortium) during June-July 2009. It was available for all participating MSs in a private area of the web platform. The electronic questionnaire was filled in by gatekeepers in each country and saved. After the closure of the survey, the database was downloaded for analysis.

Pilot study

The questionnaire was pilot tested by three VENICE project-leading partners (ISS, InVS and HPSC). The pilot study was undertaken in July 2009. After the pilot study, the questionnaire was reviewed and amended as necessary.

Data processing

Gatekeepers in each MS entered data directly on-line and saved data. The leading group contacted TBE contact points by email if clarification was needed on the responses.

Study period

MSs were asked to complete the electronic questionnaire between 5th August and 4th September 2009. The accompanying letter to MSs explained the objectives and rationale of the study.

Later the deadline was expanded due to low response rate by the 28th of September 2009.

Data analysis

Collected data were analyzed by country using Microsoft Excel and EpiInfo software and descriptive statistics were produced. Gaps and inconsistencies were verified during validation process and by direct communication with the gatekeepers. The preliminary analysis circulated among the gatekeepers and contact points to verify that the analysis was consistent with the real situation of each country.

Response rate and data validation

The response rate to the survey was 96% (28/29). One country (Luxembourg) did not respond to the survey. The response rate by the first deadline of September 4th 2009 was only 24% (7/29).

Reminder emails were sent and the deadline was established to September 11th 2009. The response rate increased to 45% (13/29). A new reminder email was sent and the deadline was extended to September 28th 2009. The response rate reached 62% (18/29). Ten countries completed the questionnaire after the third deadline.

A preliminary report with the summary of the data analysis was sent to the VENICE Gatekeepers and Contact Points on December 1st 2009. Gatekeepers and Contact Points in each country were asked to check the report and validate the results by 11th of December 2009. The report was validated by 71% (20/28) gatekeepers.

Results

Burden of disease

Among the 28 participating countries, eighteen (64%) reported evidence of TBE risk on their territory (table 1). In 94% of them incidence data was available. The highest incidence rates were reported in Estonia (10.4/100 000) and in Slovenia (9.9/100 000). Twelve countries (AU, DE, FI, FR, GR, HU, IT, NO, PL, RO, SE, SK) reported an incidence rate lower than 2 cases per 100,000 inhabitants.

Despite of occurrence of TBE in DK there is no data on absolute number of cases and incidence rates. Detailed information regarding the number of reported cases of TBE is presented in table 1.

Table 1. Number of reported cases of tick-borne encephalitis in UE/EEA countries in 2007

Country	Documented presence of TBE risk	Availability of incidence data	Absolute number of cases in 2007	Incidence per 100 000 inhabitants in 2007
Austria	Yes	Yes	46	0.58
Belgium	No	-	-	-
Bulgaria	No	-	-	-
Cyprus	No	-	-	-
Czech Republic	Yes	Yes	546	5.00
Denmark	Yes	No	-	-
Estonia	Yes	Yes	140	10.40
Finland	Yes	Yes	20	0.38
France	Yes	Yes	4	0.01
Germany	Yes	Yes	238	0.29
Greece	Yes	Yes	1	0.01
Hungary	Yes	Yes	69	0.70
Iceland	No	-	-	-
Ireland	No	-	-	-
Italy	Yes	Yes*	16	0.03
Latvia	Yes	Yes	171	7.50
Lithuania	Yes	Yes	234	6.89
Malta	No	-	-	-
Netherlands	No	-	-	-
Norway	Yes	Yes	14	0.30
Poland	Yes	Yes	233	0.61
Portugal	No	-	-	-
Romania	Yes	Yes	67	1.44
Slovakia	Yes	Yes	57	1.06
Slovenia	Yes	Yes	199	9.90
Spain	No	-	-	-
Sweden	Yes	Yes	181	1.97
United Kingdom	No	-	-	-

*data available only in some regions

Surveillance of tick-borne encephalitis

Seventeen participating countries (61%) developed surveillance systems for TBE. Surveillance is mandatory in fifteen countries (88%) (AT, CZ, EE, FI, DE, GR, HU, LV, LT, NO, PL, RO, SK, SI, SE), in two countries (BE, IT) it is voluntary (table 2). Only three countries (BE, DE, PL) implemented standardized case definition for surveillance purposes (table 3). In four countries (AT, CZ, FI, GR) no standardized definition exists, but only laboratory confirmed cases are reported to surveillance systems.

All countries with surveillance of TBE used ELISA test to confirm TBE, PCR is used in 10 countries (59%), IFA in 8 countries (47%), VNT in 6 countries (35%), HIA and VI in 4 countries (23%), WB in 3 countries (18%), SEQ in 2 countries (12%), CFT in 1 country (6%).

Table 2. Surveillance systems on tick-borne encephalitis in UE/EEA countries, 2009

Country	Surveillance of TBE	Type of reporting	Case definition of TBE for surveillance purposes	Diagnostic assays*
Austria	Yes, at national level	Mandatory	No	ELISA, VNT, PCR, HIA, SEQ
Belgium	Yes, at national level	Voluntary	Yes, since 2008	ELISA, PCR
Bulgaria	No	-	-	-
Cyprus	No	-	-	-
Czech Republic	Yes, at national level	Mandatory	No	ELISA, CFT, VNT, IFA
Denmark	No	-	-	-
Estonia	Yes, at national level	Mandatory	No	ELISA, IFA, WB
Finland	Yes, at national level	Mandatory	No	ELISA, PCR, HIA
France	No	-	-	-
Germany	Yes, at national level	Mandatory	Yes, since 2001	ELISA, VNT, PCR, IFA, VI
Greece	Yes, at national level	Mandatory	No	ELISA, PCR, IFA, VI
Hungary	Yes, at national level	Mandatory	No	ELISA, VNT, PCR, HIA, IFA, VI, SEQ
Iceland	No	-	-	-
Ireland	No	-	-	-
Italy	Yes, at national level**	Voluntary	No	ELISA, HIA, VNT
Latvia	Yes, at national level	Mandatory	No	ELISA
Lithuania	Yes, at national level	Mandatory	No	ELISA, PCR
Malta	No	-	-	-
Netherlands	No	-	-	-
Norway	Yes, at national level	Mandatory	No	ELISA, PCR, IFA
Poland	Yes, at national level	Mandatory	Yes, since 2005	ELISA
Portugal	No	-	-	-
Romania	Yes, at sub-national level	Mandatory	No	ELISA, WB
Slovakia	Yes, at national level	Mandatory	No	ELISA
Slovenia	Yes, at national level	Mandatory	No	ELISA, PCR, IFA, VI
Spain	No	-	-	ELISA, PCR
Sweden	Yes, at national level	Mandatory	No	ELISA, VNT, PCR, IFA, WB
United Kingdom	No	-	-	-

* ELISA (enzyme-linked immunosorbent assay), CFT (complement fixation test), VNT (virus neutralization), PCR (polymerase chain reaction), HIA (haemagglutination inhibition assay), IFA (immunofluorescence assay), WB (Western blot), VI (virus isolation), SEQ (sequencing)

**The surveillance is at national level as generic viral encephalitis. However in some regions voluntarily TBE cases are specifically reported in exhaustive way.

Table 3. Tick-borne encephalitis case definitions used in UE/EEA countries, 2009

Country	Clinical criteria	Laboratory criteria	Epidemiological criteria	Possible case	Probable case	Confirmed case
Belgium	Any person with an acute illness characterized by sudden onset of fever and at least one of the following symptoms: headache, neurological signs of aseptic meningitis or encephalitis, myelitis or radiculitis.	Probable case- IgM positive in a unique serum sample. Confirmed case- Seroconversion or fourfold antibody (IgM or IgG) increase in paired serum samples without a recent TBE vaccination. Detection of virus nucleic acid in sera or cerebrospinal fluid or tissue or other body fluids by PCR (if necessary the sample will be sent to a WHO Reference Laboratory in Europe).	Travel to endemic area within the last four weeks before onset of illness with or without reported tick bite.	Any person meeting the clinical criteria and with one of the epidemiological criteria.	Any person meeting the clinical criteria and with one of the epidemiological criteria and with the laboratory criteria for a probable case.	Any person meeting the clinical criteria and with one of the laboratory criteria for a confirmed case.
Germany	Clinical picture of acute tick-borne encephalitis infection, defined by at least one of the following two criteria: - flu like illness, - symptoms of central nervous system infection (e.g. Meningitis, Encephalitis, Myelitis)	Positive diagnosis with at least one of the following four methods: [direct detection of pathogen:] - - nucleic acid detection (e.g. PCR), [indirect (serological) detection:] - detection of TBE-specific IgM AND IgG antibodies (e.g. ELISA, Virus neutralisation), - marked change in titre/concentration of TBE-specific IgG antibodies between two consecutive samples - detection of intrathecal TBE-specific antibody synthesis (elevated CSF/(serum index)	n/a			Any person meeting the clinical criteria and laboratory criteria
Poland	Any person with neurological symptoms.	Probable case- detection of specific IgM antibodies in serum with no history of vaccination against any flaviviral disease during previous 3 months. Confirmed case- at least one of the following: - detection of specific IgM and IgG antibodies - detection of specific antibodies in central nervous system - confirmation of anti-TBE antibodies by neutralization test	Consumption of unpasteurized milk from this same source as confirmed case.	Any person meeting the clinical criteria and visit endemic areas during previous 6 weeks, during a period of increased tick activity (between April and November).	Any person meeting the clinical criteria and: • epidemiological criteria, OR • laboratory criteria for a probable case	Any person meeting the clinical criteria and laboratory criteria for a confirmed case.

Ascertainment of endemic areas

Endemic areas exist in 16 countries (57%) (AT, CZ, DK, EE, FI, FR, DE, HU, IT, LV, LT, PL, RO, SK, SI, SE), but only Germany developed an official definition of endemic area (table 4).

Table 4. Recognition of endemic areas in EU/EFTA countries, 2009

Country	Endemic areas	Official definition of the TBE endemic areas	Endemic areas
Austria	Yes	No	Particular Inntal of Tyrol, regions of Carynthia, of Upper Austria and of Salzburg, Lower Austria, Burgenland, Viena
Belgium	No	-	-
Bulgaria	No	-	-
Cyprus	No	-	-
Czech Republic	Yes	No	All provinces
Denmark	Yes	No	The Island of Bornholm and Tokkekoeb Hegn, a small forested area north of Copenhagen
Estonia	Yes	No	All districts
Finland	Yes	No	Aland, archipelago around Turku, some areas in Lappeenranta, some areas around Kokkola
France	Yes	No	Very low endemicity in the East of the country
Germany	Yes	Yes	42 regions in Baden-Württemberg, 78 regions in Bavaria, 8 regions in Hesse, 7 regions in Thuringia, 1 region in Rhineland-Palatine (2008 total: 136 endemic regions out of 413)
Greece	No	-	-
Hungary	Yes	No	In the North of country and West-Transdanubian Region
Iceland	No	-	-
Ireland	No	-	-
Italy	Yes	No	In some mountain in North Eastern Italy (especially in the area of Belluno and Feltre city)
Latvia	Yes	No	Different parts. More endemic North western part of the country
Lithuania	Yes	No	In the North and Middle parts of the country
Malta	No	-	-
Netherlands	No	-	-
Norway	No	-	-
Poland	Yes	No	Two North-Eastern provinces (Podlaskie and Warminsko-Mazurskie), some areas in the East (Lubelskie), and South of the country (Swietokrzyskie, Opolskie and Dolnoslaskie)
Portugal	No	-	-
Romania	Yes	No	Mures and Sibiu counties
Slovakia	Yes	No	Western and north-western part of Slovakia and some disseminated foci in middle and eastern part of Slovakia
Slovenia	Yes	No	From North-West of the country through the central region to North-Eastern of the country (Regions: Gorenjska, Koroška, Ljubljanska)
Spain	No	-	-
Sweden	Yes	No	The coast and archipelago east of Stockholm. Counties around lake Mälaren
United Kingdom	No	-	-

In Germany the endemic area was defined as recorded 5-year incidence of locally-acquired cases in districts and adjoining districts significantly exceeding 1 case per 100,000 inhabitants.

Among 16 countries which identified endemic areas, 10 (63%) used number of TBE cases in administrative regions to ascertain their endemic areas (table 5). Some countries - HU, RO, SE – did not indicate any method of endemic areas ascertainment.

Table 5: Methods of ascertainment of endemic areas in UE/EEA countries, 2009

	Countries
Number of TBE cases in administrative regions	AT, CZ, DK, EE, FI, FR, IT, LT, PL, SK
Incidence of TBE in administrative regions	CZ, DE, EE, FI, IT, LT, LV, SI
Detection of virus in wildlife	CZ, DK, FI
Seroprevalence survey in human population	FI, FR, LT
Serological survey in wild or domestic animals	FI

Although a lot of countries indicated diverse, often very sophisticated methods of confirmation of presence of endemic areas (detection of virus in ticks, screening of sentinel animals), there is no indication that these methods are used routinely, and repeatedly, in order to monitor eventual fluctuations in endemic areas extent.

Fifteen countries (94% of countries with endemic areas) disseminate information on TBE high-risk areas to the public. The most common modality for dissemination is represented by risk maps in printed materials or in internet (table 6).

Table 6. Dissemination of information on TBE high-risk areas in UE/EEA countries, 2009

	Country
Information on risk areas is not disseminated	FR
Risk maps in the internet	AT, CZ, DE, EE, FI, IT, SE, SI, SK
Risk maps in printed materials	CZ, DE, EE, FI, HU, IT, LT, SE, SI
Tables with list of administrative regions	DE, LV, LT, SI, SK
Other	DK, FI, HU, IT, PL, RO, SE

Seven countries (47%) use other ways of dissemination information about high-risk areas: DK- use description in the weekly bulletin EPI-NEWS; FI- use articles in magazines, medical and non medical journals; HU- use epidemiological bulletin and website. IT- use general information in printed materials; PL – use information on local Public Health authorities websites; RO - use official reports of Regional Public Health Institute; SE- use information on National Institute of Public Health website.

The most common places where information on high-risk areas are disseminated are: National Institutes of Public Health (81%), local public health authorities (75%) and vaccination centres (62%) (table 7).

Table 7. Place where the information on high-risk areas is disseminated in UE/EEA countries, 2009

	Country
National Institute of Public Health	AT, CZ, DE, DK, EE, FI, FR, HU, LV, RO, SE, SI, SK
Ministry of Health	CZ, DE, FI, HU, LT
Local public health authority	AT, DE, CZ, EE, FI, HU, IT, LT, PL, SE, SI, SK
Vaccination Centre	AT, CZ, EE, FI, HU, IT, PL, SE, SI, SK
General Practitioner	AT, CZ, DE, FI, HU, IT, PL
Travel agencies	DE, FI, HU
Other	DE, DK, RO

Six countries use a list of countries and/or maps with depiction of high risk areas for definition of endemic areas for travel recommendations (table 8).

Table 8. Representation of high-risk areas for travel recommendations in UE/EEA countries, 2009

	Country
List of countries	DE, DK, FI, SE, SI
Maps with depiction of high-risk areas	FI, SI, SK

Vaccination recommendations

At least one vaccine is registered in 22 countries (79%) (AT, BE, CZ, DE, DK, EE, FI, FR, HU, IS, IE, IT, LV, LT, NL, NO, PL, PT, SK, SI, SE, UK). Vaccine against TBE is recommended for general population in 8 countries (29%; 8/28), in 4 of them (AT, FI, DE, LV) vaccine is included into routine immunization schedule.

In AT, CZ and SI the recommendation is at national level, in Finland at sub national level and in four countries (DE, SE, EE, LV) only in endemic areas.

In Germany, vaccination is recommended only for people living or visiting endemic areas, while in a specific German state (Germany Baden-Württemberg) it is recommended for the general population.

Vaccine recommendations for occupational high-risk groups were developed in twelve countries (42%; 12/28) (CZ, DE, EE, FI, HU, LV, PL, SK, SI, UK, DK, IT) and for other risk groups in 11 countries (39%; 11/28). Ten countries recommend vaccine for forestry and woodcutting workers (92%; 11/12), eight countries recommend vaccine for people going on holidays and leisure time (hike, camp, hunt) (table 9).

Table 9. Vaccine recommendations in UE/EEA countries, 2009

Risk group	Country			
	at national level	at subnational level	endemic areas	Without specific recommendation
GENERAL POPULATION				
All age groups	AT, CZ, SI		DE, SE, EE	BE, BG, CY, DK, ES, FR, GR, HU, IE, IS, IT, LT, MT, NL, NO, PL, PT, RO, SK, UK
Specific age groups		FI	LV	SK, UK
OCCUPATIONAL RISK				
Forestry, woodcutting workers	CZ, EE, HU LV, PL, SI, SK	FI	DE, DK	AT, BE, BG, CY, ES, FR, GR, IE, IS, IT, LT, MT, NL, NO, PT, RO, SE, UK
Agriculture workers	EE, HU, PL, SI, SK		DE	AT, BE, BG, CY, CZ, DK, ES, FI, FR, GR, IE, IS, IT, LT, LV, MT, NL, NO, PT, RO, SE, UK
Military service	CZ, EE, LV, PL, SI, SK		DK	AT, BE, BG, CY, DE, ES, FI, FR, GR, HU, IE, IS, IT, LT, MT, NL, NO, PT, RO, SE, UK
Police	CZ, EE, LV, SI, SK			AT, BE, BG, CY, DE, DK, ES, FI, FR, GR, HU, IE, IS, IT, LT, MT, NL, NO, PL, PT, RO, SE, UK
Laboratory workers, who may be exposed to TBE	CZ, DE, EE, LV, SI, SK, UK			AT, BE, BG, CY, DK, ES, FI, FR, GR, HU, IE, IS, IT, LT, MT, NL, NO, PL, PT, RO, SE
Border guards	CZ, EE, LV, PL, SI			AT, BE, BG, CY, DE, DK, ES, FI, FR, GR, HU, IE, IS, IT, LT, MT, NL, NO, PT, RO, SE, SK, UK
Forest rangers	CZ, DE, EE, LV, PL, SI, SK	FI		AT, BE, BG, CY, DK, ES, FR, GR, HU, IE, IS, IT, LT, MT, NL, NO, PT, RO, SE, SK, UK
Every person working mainly outdoor	CZ, EE, SK, SI		DK, DE, IT	AT, BE, BG, CY, DE, ES, FI, FR, GR, HU, IE, IS, LT, LV, MT, NL, NO, PL, PT, RO, SE, UK
Other	EE, SK			AT, BE, BG, CY, CZ, DE, DK, ES, FI, FR, GR, HU, IE, IS, IT, LT, LV, MT, NL, NO, PL, PT, RO, SE, SI, UK
OTHER RISK				
Outdoor sport	SI	FI	DK, HU, IT, NO, SK	AT, BE, BG, CY, CZ, DE, EE, ES, FR, GR, IE, IS, LT, LV, MT, NL, PL, PT, RO, SE, UK
Holidays and leisure time (hike, camp, hunt)	PL, SI	FI	DK, HU, IT, NO, SK	AT, BE, BG, CY, CZ, DE, EE, ES, FR, GR, IE, IS, LT, LV, MT, NL, PT, RO, SE, UK
Mushroom, berries collectors	SI	FI	SK	AT, BE, BG, CY, CZ, DE, DK, EE, ES, FR, GR, HU, IE, IS, IT, LV, LT, MT, NL, NO, PL, PT, RO, SE, UK
Other		DE	LV	AT, BE, BG, CY, CZ, DK, EE, ES, FI, FR, GR, HU, IE, IS, IT, LT, MT, NL, NO, PL, PT, RO, SE, SI, SK, UK

In Finland vaccination for people above 7 years at sub-national level is recommended. In Latvia vaccination for children under 18 years in endemic areas is recommended.

Some countries have recommendations for other risk groups. In Estonia vaccination for agriculture and biology students is recommended. In Slovakia vaccination for employees at railroads is recommended. In Latvia occupationally exposed to hosts of tick-borne encephalitis are eligible for free-of-charge vaccination. In Hungary the

general principle is that TBE vaccination recommended for all workers at biological risk, and it is independent on occupation.

Vaccination is recommended to individuals travelling into an endemic area inside country in ten countries (62%) (AT, CZ, EE, FI, DE, HU, PL, SE, SK, SI). IE recommends that travelers who plan to camp or trek through forests should consider vaccination.

Vaccination coverage

Seven countries (AT, DE, EE, IS, LV, PL, SI) have established a mechanism for assessing TBE vaccination coverage (table 10). Six countries at national level, and one at sub-national level. Most of them (AT, EE, DE, PL, SI) assess vaccination coverage annually.

Table 10. Vaccine coverage assessment

Vaccine coverage mechanism	Countries
Mechanism for monitoring the TBE vaccination coverage	
At national level	AT, EE, IS, LV, PL, SI
At sub-national level	DE
Vaccination coverage assessed	
Regularly, annually	AT, EE, DE, PL, SI
Regularly, other intervals	LV
Irregularly (ad hoc surveys)	IS
Available data on TBE vaccination coverage	
At national level	AT, EE, LV, PL
At sub-national level	DE

Five countries have detailed vaccination coverage data at national level (tab.11) for 2007.

Table 11. Vaccination coverage in 2007 in EU/EFTA

Country	Vaccination coverage (%) in 2007
Austria	88
Czech Republic*	17
Estonia	6,2
Latvia	9,4
Poland	0,8

*In Czech Republic the vaccine coverage estimates come from annual surveys performed by the social research company GfK, according to a contract with vaccine manufacturer.

To obtain the numerator necessary for assessing TBE vaccine coverage, six countries (AT, EE, DE, IS, PL, SI) use health record data. Two countries (DE, AT) use immunization surveys for this purpose, and 4 countries (AT, IS, DE, LV) pharmaceutical sales data (table 12).

Table 12. Methods of numerator measurement for vaccination coverage

Methods of coverage assessment	Country
Health record data	
Medical records	AT, EE, DE, PL, SI
Computerized medical records (not specific to immunization)	IS
Immunization survey	
Telephone survey	DE
Mail survey	AT
Pharmaceutical data	
Pharmaceutical distribution data (from national purchaser)	AT, IS
Pharmaceutical sales data (from private pharmacies)	DE
Other	LV

Latvia collected number of performed vaccinations according to monthly reports from vaccination sites. Seven countries (100%) measure denominator for general population (AT, EE, DE, IS, LV, PL, SI).

Payment and administration of TBE vaccine

The vaccine is provided free of charge for the general population at regional level or in endemic areas in DE, FI, LV. For all occupational risk groups the vaccine is provided free of charge in HU. For some occupational risk groups the vaccine is provided free of charge in CZ, DE, EE, FI, LV, PL, SI, UK (table 13). In DE vaccine is free of charge also for tourists who visiting the endemic area.

Table 13. Payment and administration

Cost category	Countries		
	at national level	at regional level	in endemic areas
General population			
Vaccine and administration free of charge		FI	DE, LV
Partial subsidy for vaccine and administration (below cost to recipient)	AT, CZ		
Full vaccine and administration cost paid by recipients	SI		EE, SE
Vaccine free of charge, administration cost paid by recipient			
Forestry, woodcutting workers			
Vaccine and administration free of charge	EE*, HU, LV, SI	FI, PL	DE
Partial subsidy for vaccine and administration (below cost to recipient)	CZ		
Full vaccine and administration cost paid by recipients	SK		DK
Vaccine free of charge, administration cost paid by recipient			
Agriculture workers			
Vaccine and administration free of charge	EE*, HU, SI		DE
Partial subsidy for vaccine and administration (below cost to recipient)			
Full vaccine and administration cost paid by recipients	PL, SK		
Vaccine free of charge, administration cost paid by recipient			

Table 13. - cont.

Cost category	Countries		
	at national level	at regional level	in endemic areas
Military service			
Vaccine and administration free of charge	CZ, DE, EE*, LV, SI		
Partial subsidy for vaccine and administration (below cost to recipient)			
Full vaccine and administration cost paid by recipients	SK		DK
Vaccine free of charge, administration cost paid by recipient			
Police			
Vaccine and administration free of charge	EE*, LV, SI		
Partial subsidy for vaccine and administration (below cost to recipient)	CZ		
Full vaccine and administration cost paid by recipients	SK		
Vaccine free of charge, administration cost paid by recipient			
Laboratory workers, who may be exposed to TBE			
Vaccine and administration free of charge	CZ, DE, EE*, LV, SI, SK*, UK		
Partial subsidy for vaccine and administration (below cost to recipient)			
Full vaccine and administration cost paid by recipients			
Vaccine free of charge, administration cost paid by recipient			
Border guard			
Vaccine and administration free of charge	EE*, LV, SI	PL	
Partial subsidy for vaccine and administration (below cost to recipient)	CZ		
Full vaccine and administration cost paid by recipients			
Vaccine free of charge, administration cost paid by recipient			
Forest ranger			
Vaccine and administration free of charge	EE*, LV, SI	PL, FI	DE
Partial subsidy for vaccine and administration (below cost to recipient)	CZ		
Full vaccine and administration cost paid by recipients	SK		
Vaccine free of charge, administration cost paid by recipient			
Every person working mainly outdoor			
Vaccine and administration free of charge	EE*, SI		DE
Partial subsidy for vaccine and administration (below cost to recipient)	CZ		IT
Full vaccine and administration cost paid by recipients	SK		DK
Vaccine free of charge, administration cost paid by recipient			

*EE, SK- Full vaccine and administration cost paid by employer.

Vaccination recommendations for tourists going abroad

Travel recommendations were developed and published in twenty-two countries (78%).

- 17 countries used website to disseminate vaccination recommendations for tourists, 12 countries used booklet, 4 countries technical documents.
- Travel recommendations are available in vaccination centre (15 countries), National Institutes of Public Health (14 countries), Local public health authorities (12 countries), Ministry of Health (9 countries), general practitioner (8 countries), travel agencies (6 countries).

Table 14. Dissemination of travel recommendations

	Country
Recommendations to people travelling abroad	AT, BE, CZ, DE, DK, EE, ES, FI, FR, GR, HU, IE, IS, IT, LV, NO, PL, RO, SE, SI, SK, UK,
Disseminations of travel recommendations	
Website	BE, CZ, DE, DK, EE, ES, FI, FR, GR, HU, IT, LV, NO, SE, SI, SK, UK
Booklet	BE, DE, EE, FI, FR, HU, LV, NO, SE, SI, SK, UK
Technical documents	DE, ES, FR, IE
Other	LV
Place where the information is available	
National Institute of Public Health	AT, BE, CZ, DE, EE, FI, HU, IE, LV, NO, SE, SI, SK, UK
Ministry of Health	AT, BE, DE, ES, FI, FR, GR, HU, UK
Local public health authority	AT, BE, DE, EE, FI, HU, IT, PL, RO, SE, SI, SK,
Vaccination Centre	AT, BE, EE, ES, FI, FR, HU, IE, IT, LV, PL, SI, SE, SK, UK
General Practitioner	AT, BE, DE, FI, FR, HU, IE, LV
Travel agencies	BE, DE, EE, ES, HU, SK
Other	DK, IE

Discussion

Out of 28 countries, 18 reported evidence of TBE risk in the country, and 16 countries have developed surveillance systems for TBE. However, only 3 countries introduced standardized case definition for TBE. Cases are therefore ascertained mostly based on physicians decision, and use of diverse diagnostic tests. In this situation a “case” in one country means something different, than in another country, or even different region in the same country.

As shown in previous investigations, in regions where long-standing surveillance systems for TBE are in place, a higher sensitivity in the identification of cases is observed, mostly related to the more common use of diagnostic testing. The opposite situation is observed in regions reporting only sporadic cases, where physicians are less likely to perform diagnostic testing [5]. Considering that, in many European regions where surveillance is either not present, or developed recently, imported cases and food-borne cases will not be detected.

The second important consideration is the difference among countries in ascertainment of high-risk areas, where TBE virus circulation is particularly intensive. TBE endemic areas are recognized in 16 countries, but only one of them developed a standardized definition of endemic area. There is no widely accepted definition of endemic area, and some countries use different methods to ascertain endemicity; most of them use the number of reported cases, or reported incidence (without any threshold). In general, most countries rely on reported human cases, which limitations were discussed previously. Some countries have implemented monitoring TBE virus presence through detection of the virus in animals and ticks. However, these methods will be useful, if applied regularly, as a routine surveillance tool (for example in 5-year intervals). Considering that TBE is focally distributed disease, relying on human surveillance will not allow detection of fluctuations in geographic distribution of TBE high-risk areas. In regions where high vaccination coverage was achieved, human surveillance information will underestimate the true risk for TBE. Of 18 countries with documented TBE risk, 16 developed vaccination recommendations for the general population and/or high-risk groups. Eight countries have recommendations for general population, but most of them recommend only vaccination of residents of endemic areas. Considering the discussed limitations of our understanding of TBE high-risk areas, these recommendations may either refer to local administration judgment on whether its area is “endemic”, or publication of lists of endemic administrative entities, based on unspecified criteria.

Among the 16 countries who developed vaccination recommendations for the general population and/or high-risk groups, only 7 have a mechanism for assessing vaccination coverage. Together with the development of a specific surveillance system, the monitoring of vaccination uptake is essential to follow up the epidemiology of the infection/disease.

In all countries, where the vaccine is registered individuals planning to visit foreign endemic areas are recommended to be vaccinated. As this was discussed previously however, information on distribution on endemic areas was not available in several countries, especially those which record TBE foci only on part of their territory. The information on travel recommendations was available in vaccination centres or travel agencies only in some countries. The most common way of dissemination of travel recommendations were websites and official publications of public health institutions.

Conclusions and Recommendations

- Standardization of surveillance systems in EU/EFTA countries will allow particular countries development of TBE vaccination recommendations addressing appropriate target groups.
- Application of surveillance case definitions, and encouraging laboratory confirmation of CNS infections, will allow appropriate assessment of disease burden.

- Despite its local occurrence only in part of EU countries, with increasing travel, and free trade of food products, more priority to TBE should be given at European level.
- Development of vaccination recommendations, especially directed to travellers, necessitates adoption of compatible definitions of high-risk areas across European countries.
- Based on clear definitions of high-risk areas, risk maps should be widely disseminated, using national public health authorities, vaccination points, and travel agencies.

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2. Barret P.N., Plotkin S.A., Ehrlich H.J. Tick-borne encephalitis virus vaccines. In *Vaccines* 5th edition. 2008 Elsevier
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4. Donoso, Mantke O., R. Schadler, and M. Niedrig. "A survey on cases of tick-borne encephalitis in European countries." *Euro.Surveill* 13.17 (2008).
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Appendix 1. Main study results presented in figures

Figure 1. Number of reported cases of tick-borne encephalitis in EU/EEA countries in 2007

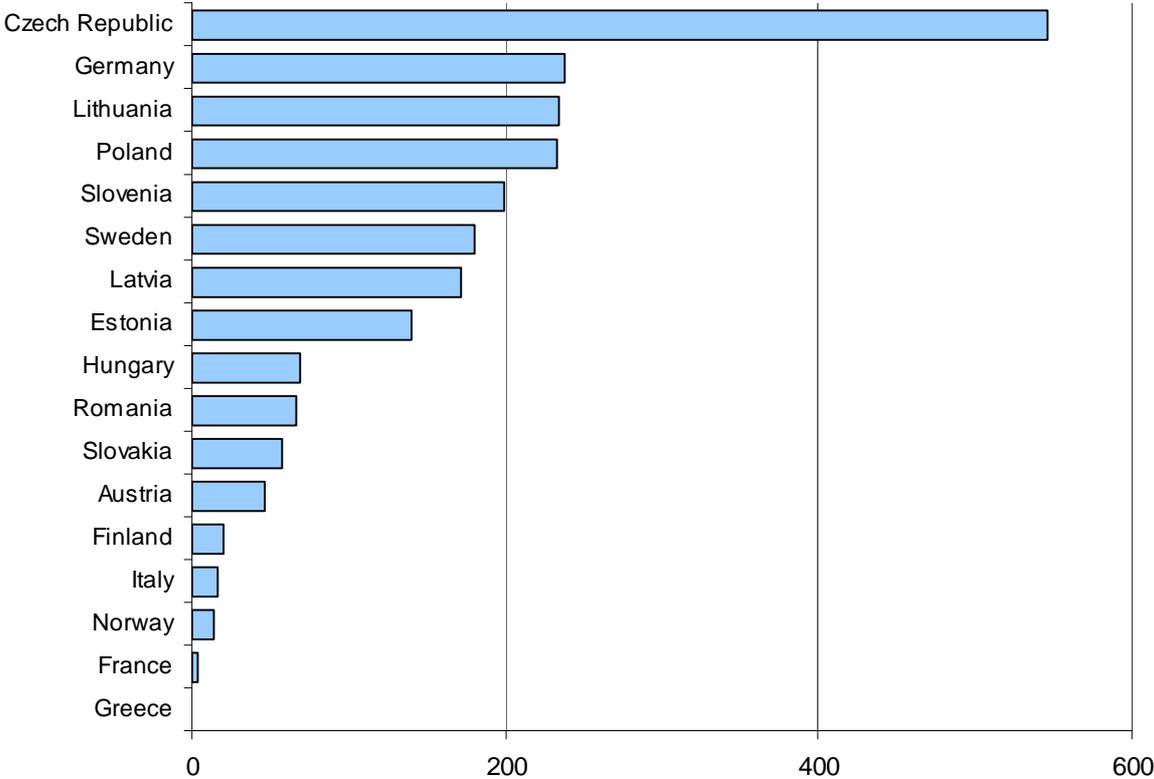


Figure 2. Type of diagnostic assays of TBE in UE/EEA countries, 2009

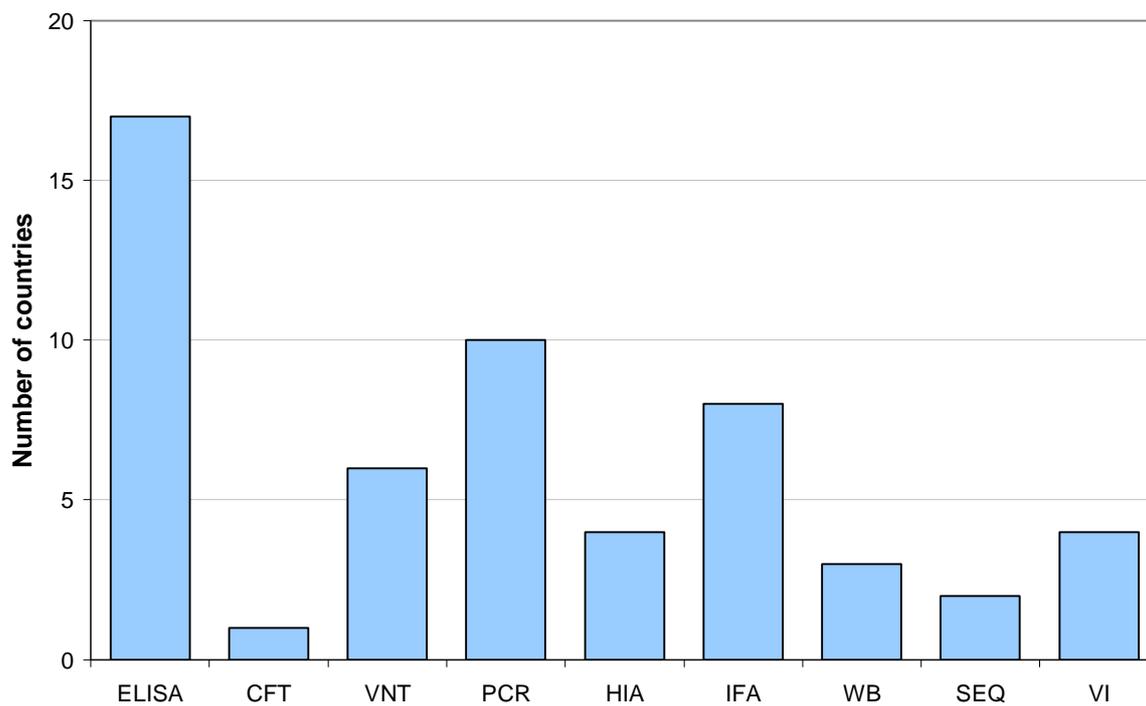


Figure 3. Vaccine recommendations for risk groups in EU/EEA countries, 2009

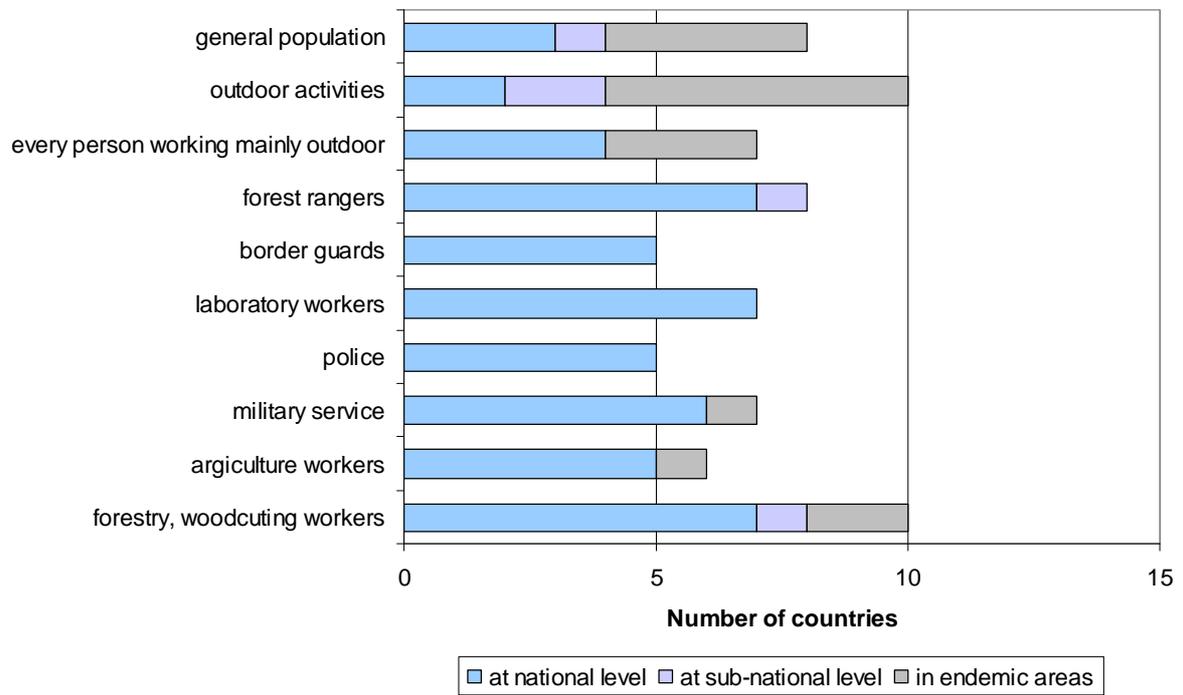


Figure 4. Dissemination of travel recommendations in UE/EEA countries, 2009

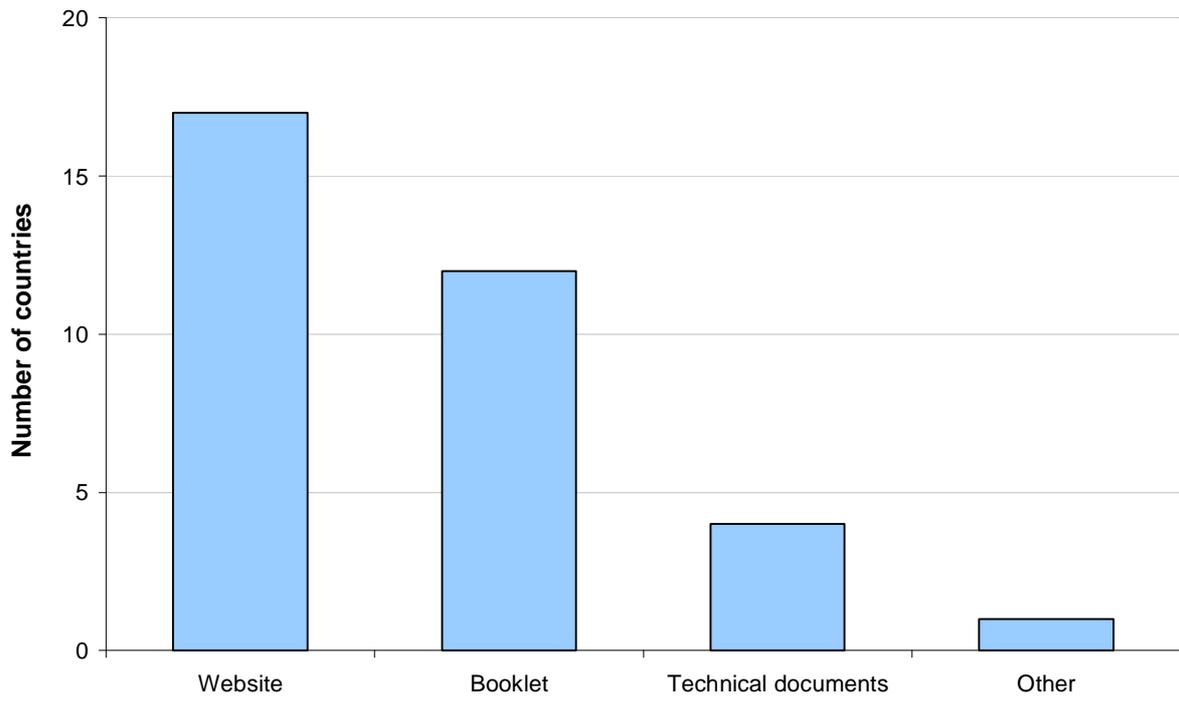


Figure 5. Type of reporting of TBE in EU/EEA countries, 2009

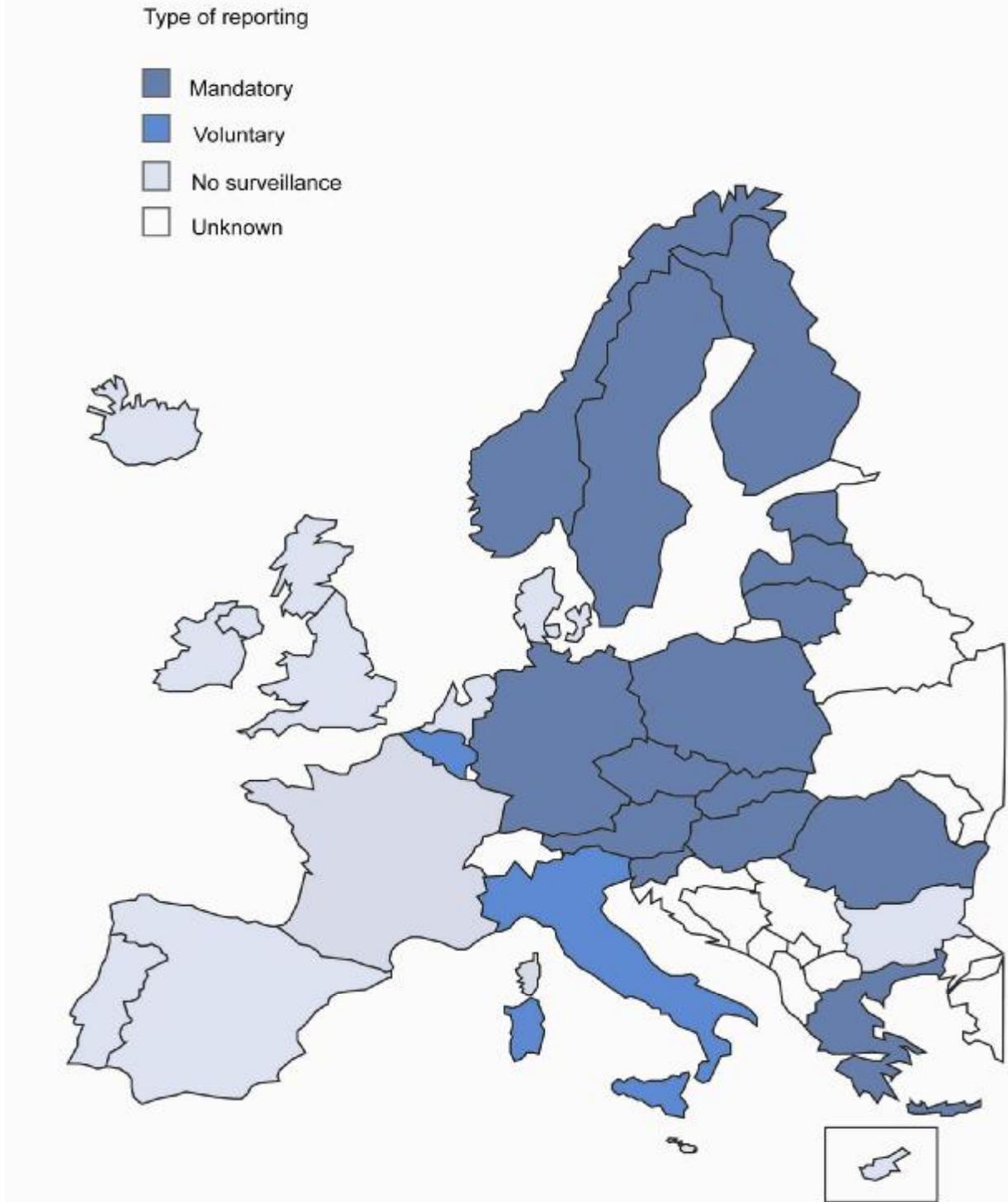


Figure 6. Registration of TBE vaccine in EU/EEA countries, 2009

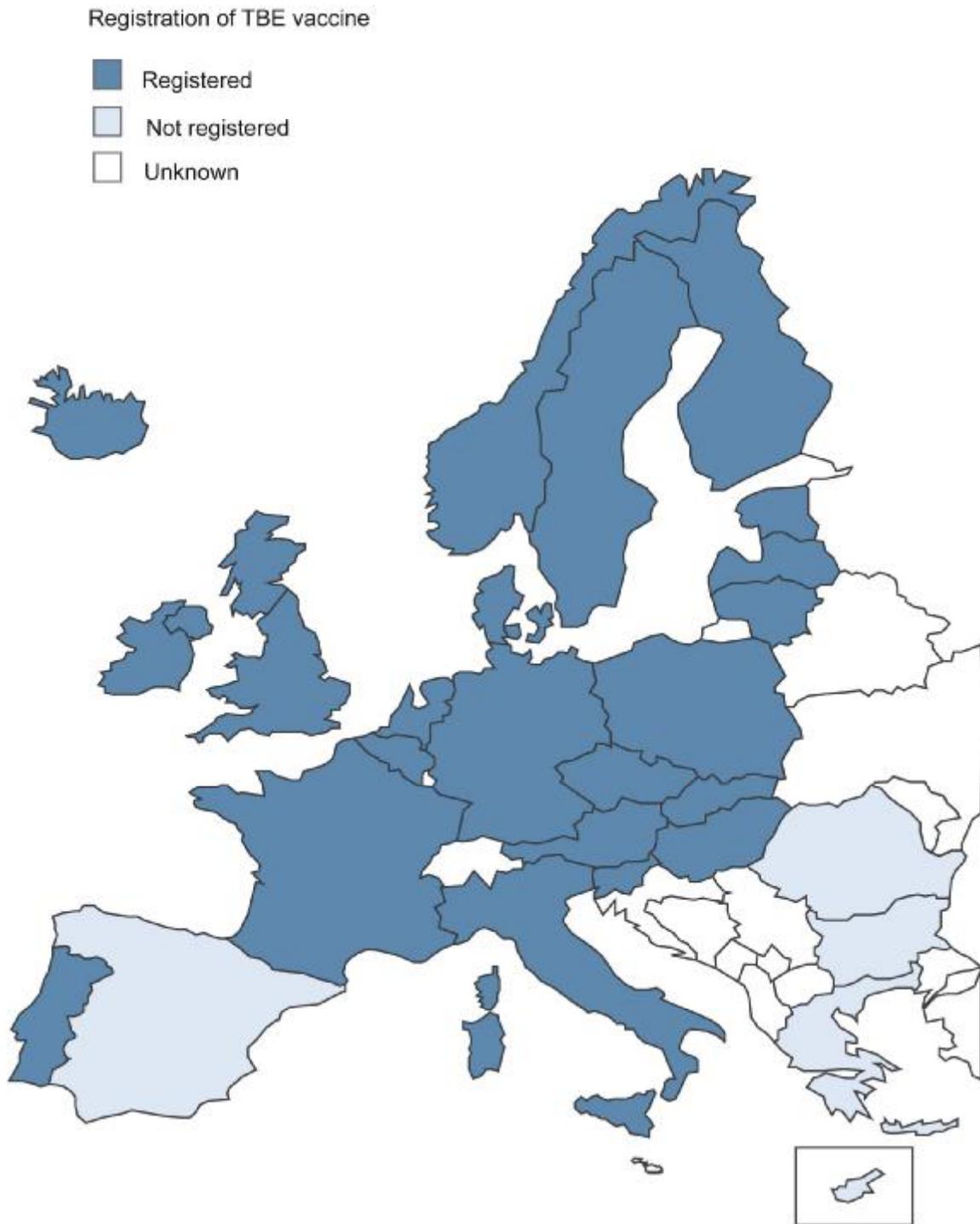


Figure 7. Recommendation of TBE vaccination for general population in EU/EEA countries, 2009

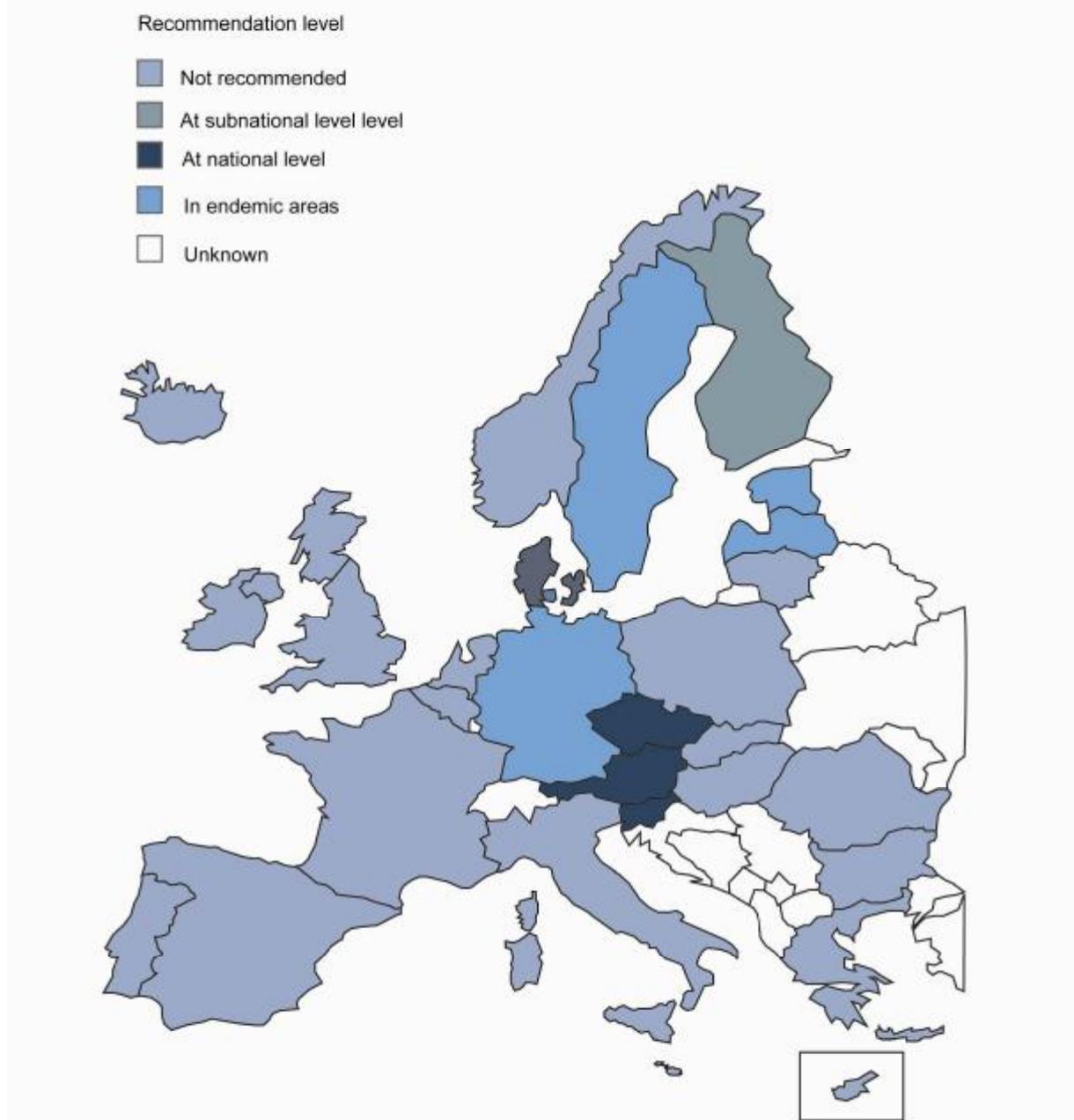


Figure 8. Recommendations of TBE vaccination for high risk groups in EU/EEA countries, 2009

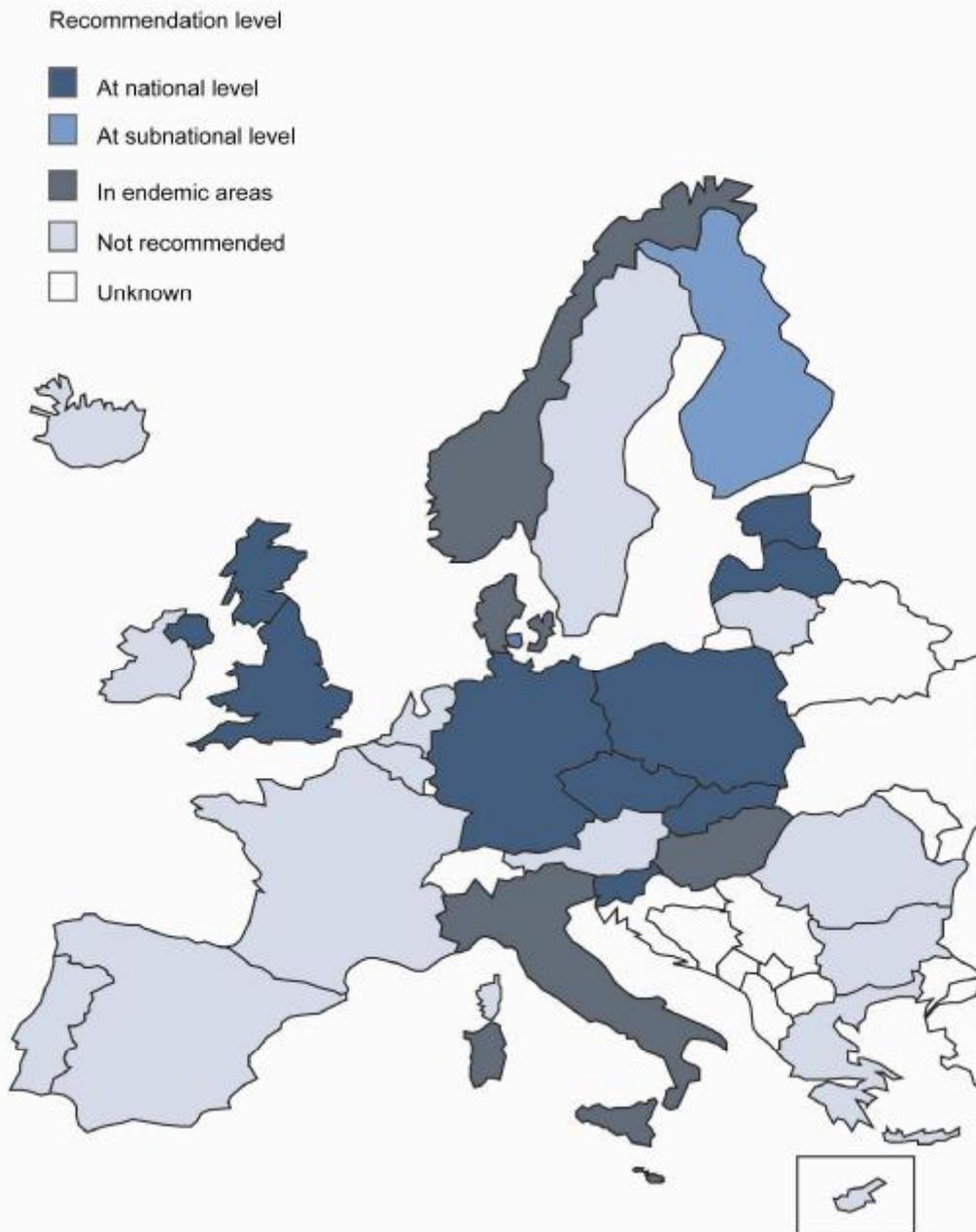
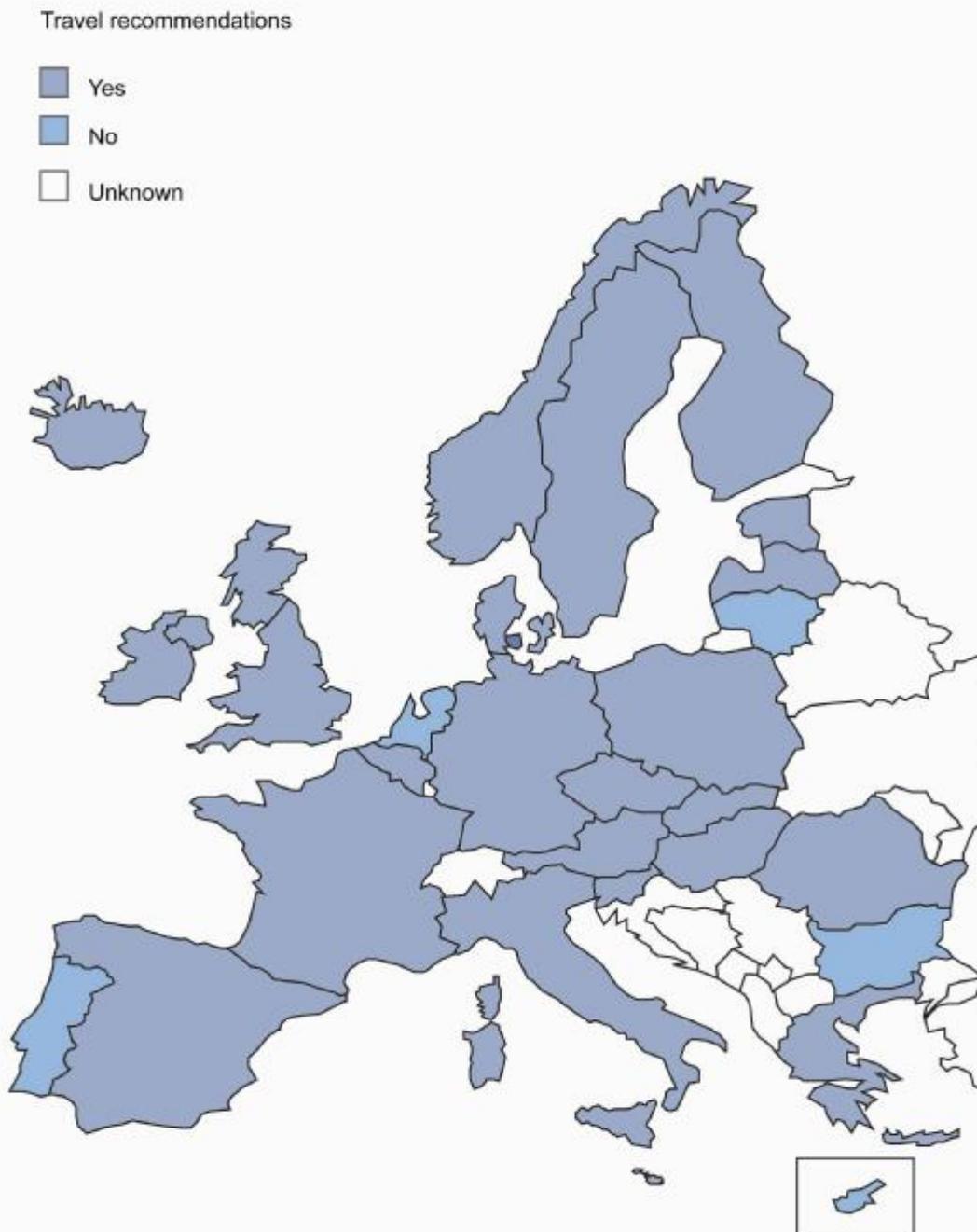


Figure 9. Vaccination recommendations for tourist going abroad in EU/EEA countries, 2009



Appendix 2. Questionnaire

QUESTIONNAIRE OF TBE VACCINATION RECOMMENDATIONS IN EU/EEA

1. Is there documented presence of TBE risk in your country?

- Yes
- No

2. Are TBE incidence data available in your country?

- Yes
- No

3. Please specify how many human cases were reported in 2007 in your country ?

Absolute number of cases	
Incidence rate (number of cases/100000 inhabitants)	

SURVEILLANCE OF TICK-BORNE ENCEPHALITIS

4. Is TBE a disease subjected to the surveillance system?

- Yes, at national level,
- Yes, at sub-national level (e.g. at regional level)
- Yes, only in endemic areas
- No

5. Reporting of TBE in your country is:

- Mandatory
- Voluntary

6. Is there a case definition of TBE used in your country for surveillance purposes?

- Yes
- No
- Not know

7. In which year the case definition was introduced ?

In..... year (Please specify year)

8. Please write the complete case definition below *Free text* :

--

9. Are laboratory test used to confirm TBE cases in your country?

- Yes
- No
- Not know

10. What laboratory tests are used to confirm TBE cases in your country ?

- ELISA (*enzyme-linked immunosorbent assay*)
- CFT (complement fixation test)
- VNT (virus neutralization)
- PCR (polymerase chain reaction)
- HIA (haemagglutination inhibition assay)
- IFA (immunofluorescence assay)
- WB (Western blot)
- VI (virus isolation)
- SEQ (sequencing)
- Other- specify.....

ASCERTAINMENT OF ENDEMIC AREAS

11. Are there any endemic areas of TBE in your country ?

- Yes
- No

12. Is there an official definition of the TBE endemic areas?

- Yes
- No

13. Do the TBE endemic areas correspond to administrative areas (e.g regions, local units)?

- Yes
- No

14. Please specify the endemic areas (e.g. the names of the Regions) or where they are located (e.g. in the North of the country)

Free text

15. Do you know how the endemic areas are ascertained in your country?

- Yes
- No

If yes, please specify:

- Number of TBE cases in administrative regions
- Incidence of TBE in administrative regions
- Seroprevalence survey in human population
- Detection of virus in wildlife (ticks of sentinel animal, flagging)
- Serological survey in wild or domestic animals
- Other

16. In your country is information on TBE high-risk areas disseminated ?

- Yes
- No
- Not known

If yes, please specify:

- Risk maps in the internet
- Risk maps in printed materials
- Tables with list of administrative regions
- Other (specify)

17. Do you know where is the information available?

- Yes
- No

If yes, please specify :

- National Institute of Public Health
- Ministry of Health
- Local public health authority
- Vaccination Centre
- General Practitioner
- Travel agencies
- Others (please specify.....)

18. Do you know how the endemic areas are defined for purpose of travel recommendations?

- Yes
- No
- There is no such definition

If yes, please specify

- List of countries
- Maps with depiction of high-risk areas
- Other (please specify)

VACCINATION RECOMMENDATIONS

19. Is the vaccine against TBE registered in your country?

- Yes
- No

20. Are there specific recommendations for TBE vaccination?

- Yes, at national level
- Yes, at subnational level (e.g. at regional level)
- Yes, only in endemic areas
- No

21. Is the TBE vaccination included in the routine immunization schedule for general population in your country?

- Yes, at national level
- Yes, at subnational level (e.g. at regional level)
- Yes, only in endemic areas
- No

22. For which age groups is the TBE vaccination recommended?

- All age groups
- Specific age groups (please specify.....)
- Not recommended

23. Is the TBE vaccination recommended in your country to individuals who are at increased risk by their occupation (without regard to age)?

- Yes, at national level
- Yes, at subnational level (e.g. at regional level)
- Yes, only in endemic areas
- No

24. In general, to which groups is it recommended?

- Forestry, woodcutting workers
- Agriculture workers
- Military service
- Police
- Laboratory workers, who may be exposed to TBE
- Border guard
- Forest rangers
- Every person working mainly outdoor
- Other (please specify.....)

25. Is the TBE vaccination recommended in your country to individuals who are at other risk?

- Yes, at national level
- Yes, at subnational level (e.g. at regional level)
- Yes, only in endemic areas
- No

26. In general, to which other risk groups is it recommended?

- Outdoor sport
- Holidays and leisure time (hike, camp, hunt)
- Mushroom, berries collectors
- Others (please specify.....)

27. Is the TBE vaccination recommended to individuals travelling into an endemic area (inside your country)?

- Yes
- No
- There is no official definition of endemic areas
- Not known

28. Is the TBE vaccination recommended to individuals residing in endemic areas?

- Yes
- No
- There is no official definition of endemic areas
- Not known

VACCINATION COVERAGE

29. Do you have a mechanism for monitoring the TBE vaccination coverage?

- Yes, at national level
- Yes, at sub-national level (e.g. regional level)
- Yes, only in endemic areas
- No

30. Is the vaccination coverage assessed

- Regularly, annually
- Regularly, other intervals, please specify.....
- Irregularly (ad hoc surveys)
- Not known

31. Are data on TBE vaccination coverage available in your country?

- Yes, at national level
- Yes, at sub-national level (e.g. regional level)
- Yes, in endemic region
- No
- Not known

32. What was the vaccination coverage at national level in your country in 2007?

- Percentage.....
- Unknown

33. Please, if available specify the vaccination coverage in the main subnational/endemic areas for 2007 (up to 10 areas):

	<i>Subnational/endemic areas</i>	<i>TBE vaccination coverage (%)</i>
1		
2		
3		
4		

34. Do you know the methods that your country used to measure the numerator in assessing the TBE vaccination coverage?

- Yes**
- No**

If yes, please specify:

1. Health record data
 - Medical records
 - Computerised medical records
 - Immunization survey
2. Immunization surveys
 - Household survey, in person
 - Individual interview, in person

- Telephone survey
- Mail survey

3. Pharmaceutical data
 - Pharmaceutical distribution data (from industry)
 - Pharmaceutical distribution data (from national purchaser)
 - Pharmaceutical sales data (from private pharmacies)
4. Other, please specify.....

35. For which of following population/denominators data for vaccination coverage assessment are available in your country?

- General population
- Forestry, woodcutting workers
- Agriculture workers
- Police
- Laboratory workers, who may be exposed to TBE
- Border guard
- Forest ranger
- Other, please specify

PAYMENT AND ADMINISTRATION OF TBE VACCINE

36. Is TBE vaccination subsidized in your country for general population or at risk group?

- Yes
- No

37. Vaccine administered to general population without regard to other risk indication:

1. Vaccine and administration free of charge
 - at national level
 - at regional level
 - in endemic areas
2. Partial subsidy for vaccine and administration (below cost to recipient)
 - at national level
 - at regional level
 - in endemic areas
3. Full vaccine and administration cost paid by recipients
 - at national level
 - at regional level
 - in endemic areas
4. Vaccine free of charge, administration cost paid by recipient
 - at national level
 - at regional level
 - in endemic areas
5. Not known
6. Not applicable

38. Vaccination recommended to forestry, woodcutting workers:

1. Vaccine and administration free of charge
 - at national level
 - at regional level
 - in endemic areas
2. Partial subsidy for vaccine and administration (below cost to recipient)
 - at national level
 - at regional level
 - in endemic areas
3. Full vaccine and administration cost paid by recipients
 - at national level
 - at regional level
 - in endemic areas
4. Vaccine free of charge, administration cost paid by recipient

- at national level
 - at regional level
 - in endemic areas
5. Not known
 6. Not applicable

39. Vaccination recommended to agriculture workers:

1. Vaccine and administration free of charge
 - at national level
 - at regional level
 - in endemic areas
 2. Partial subsidy for vaccine and administration (below cost to recipient)
 - at national level
 - at regional level
 - in endemic areas
 3. Full vaccine and administration cost paid by recipients
 - at national level
 - at regional level
 - in endemic areas
 4. Vaccine free of charge, administration cost paid by recipient
 - at national level
 - at regional level
 - in endemic areas
5. Not known
 6. Not applicable

40. Vaccination recommended to military service:

1. Vaccine and administration free of charge
 - at national level
 - at regional level
 - in endemic areas
 2. Partial subsidy for vaccine and administration (below cost to recipient)
 - at national level
 - at regional level
 - in endemic areas
 3. Full vaccine and administration cost paid by recipients
 - at national level
 - at regional level
 - in endemic areas
 4. Vaccine free of charge, administration cost paid by recipient
 - at national level
 - at regional level
 - in endemic areas
5. Not known
 6. Not applicable

41. Vaccination recommended to police:

1. Vaccine and administration free of charge
 - at national level
 - at regional level
 - in endemic areas
2. Partial subsidy for vaccine and administration (below cost to recipient)
 - at national level
 - at regional level
 - in endemic areas
3. Full vaccine and administration cost paid by recipients
 - at national level
 - at regional level
 - in endemic areas

4. Vaccine free of charge, administration cost paid by recipient at national level
 - at national level
 - at regional level
 - in endemic areas
5. Not known
6. Not applicable

42. Vaccination recommended to laboratory workers, who may be exposed to TBE:

1. Vaccine and administration free of charge
 - at national level
 - at regional level
 - in endemic areas
2. Partial subsidy for vaccine and administration (below cost to recipient)
 - at national level
 - at regional level
 - in endemic areas
3. Full vaccine and administration cost paid by recipients
 - at national level
 - at regional level
 - in endemic areas
4. Vaccine free of charge, administration cost paid by recipient
 - at national level
 - at regional level
 - in endemic areas
5. Not known
6. Not applicable

43. Vaccination recommended to border guard:

1. Vaccine and administration free of charge
 - at national level
 - at regional level
 - in endemic areas
2. Partial subsidy for vaccine and administration (below cost to recipient)
 - at national level
 - at regional level
 - in endemic areas
3. Full vaccine and administration cost paid by recipients
 - at national level
 - at regional level
 - in endemic areas
4. Vaccine free of charge, administration cost paid by recipient
 - at national level
 - at regional level
 - in endemic areas
5. Not known
6. Not applicable

44. Vaccination recommended to forest ranger:

1. Vaccine and administration free of charge
 - at national level
 - at regional level
 - in endemic areas
2. Partial subsidy for vaccine and administration (below cost to recipient)
 - at national level
 - at regional level
 - in endemic areas
3. Full vaccine and administration cost paid by recipients
 - at national level
 - at regional level

- in endemic areas
- 4. Vaccine free of charge, administration cost paid by recipient
 - at national level
 - at regional level
 - in endemic areas
- 5. Not known
- 6. Not applicable

45. Vaccination recommended to every person working mainly outdoor:

- 1. Vaccine and administration free of charge
 - at national level
 - at regional level
 - in endemic areas
- 2. Partial subsidy for vaccine and administration (below cost to recipient)
 - at national level
 - at regional level
 - in endemic areas
- 3. Full vaccine and administration cost paid by recipients
 - at national level
 - at regional level
 - in endemic areas
- 4. Vaccine free of charge, administration cost paid by recipient
 - at national level
 - at regional level
 - in endemic areas
- 5. Not known
- 6. Not applicable

VACCINATION RECOMMENDATIONS FOR TOURISTS GOING ABROAD

46. Is the TBE vaccination recommended to people travelling abroad?

- Yes
- No

47. Do you know how travel recommendations are disseminated to the public?

- Yes
- No

If yes, please specify:

- Website
- Booklet
- Public health institution
- Technical documents
- Other (please specify.....)

48. Do you know where is the information available?

- Yes
- No

If yes, please specify:

- National Institute of Public Health
- Ministry of Health
- Local public health authority
- Vaccination Centre
- General Practitioner
- Travel agencies
- Others