

TBE in Mongolia

Tserennorov Damdindorj, Uyanga Baasandagva, Uranshagai Narankhuu,
Burmaa Khoroljav, Tsogbadrakh Nyamdorj, Burmaajav Badrakh

E-CDC risk status: endemic (last edited in May 2025, update for 2024: no data)

History and current situation

In Mongolia, tick-borne encephalitis virus was first isolated (Kraminskii V.A) from marmot liver in Dornod province in 1979 while the *Ixodes persulcatus* tick was identified in 1987 by M.Dash.^{1,2} *Ixodes persulcatus* is a taiga tick distributed in coniferous forests consisting mostly of pines, spruces and larches.³ Much of northern Mongolia is covered in coniferous forest and the southern edge of the Siberian taiga is located along the Khangai and Khentii mountains.

In the 1980s Mongolian scientists worked together with researchers from the Institute of Epidemiology and Microbiology of Irkutsk, Russia to investigate the spread of ticks carrying the TBEV in the forest areas of Khuvsgul, Khentii, Bulgan, Selenge, Orkhon, Central, Dornod, Arkhangai and Uvurkhangai provinces, which had been identified as TBEV-endemic regions.⁴ Finally, in 1989, following available local information on diseases suspected to be TBE, Abmed et al. documented natural foci of the TBEV in the administrative districts of Zelter, Bugant and Khuder in the Selenge province and noted that it is important to plan and implement preventive measures.⁵

The physician of the Khuder district in the province of Selenge remembers that she had treated more than 400 patients with clinical signs of tick-borne encephalitis from 1993-2000. Five of them had died and had been recorded as, viral infections“. This is the evidence to indicate that TBE was prevalent at that time.⁶

The Selenge province was found to carry the highest counts of *I. persulcatus* ticks frequently infected with the TBEV. *I.persulcatus* ticks were also found to be abundant in Bulgan, Tuv, Khuvsgul and Orkhon provinces of Mongolia.^{1,7,10} Human cases of TBE have been officially registered at the national level since 2005.

During 2005-2023, 405 confirmed cases have been registered in Arkhangai, Bayankhongor, Bulgan, Darkhan-Uul, Dundgobi, Dornod, Orkhon, Uvurkhangai, Selenge, Tuv, Uvs, Khunsgul, Khentii, Bayan-Ulgii provinces and Ulaanbaatar city. Most patients remembered a tick bite to have occurred in the areas of Selenge (78%) and the Bulgan (12%) provinces. There were 21 fatal cases (CFR 4.85%) attributed to severe meningoencephalitis (Figure 1).

Since 2005, prevention measures such as vaccination, training and advocacy among the population have been administered but human cases continue to registered. Between 2014-2017 the number of reported TBE cases and deaths increased annually, but it was decreasing in the last 5 years (2018-2022). In 2023, human morbidity increased 4.25 times compared to the previous year. TBE cases have been notified from areas without the main vector *I. persulcatus* and moreover the expansion of natural TBE-foci is observed.⁸⁻¹²

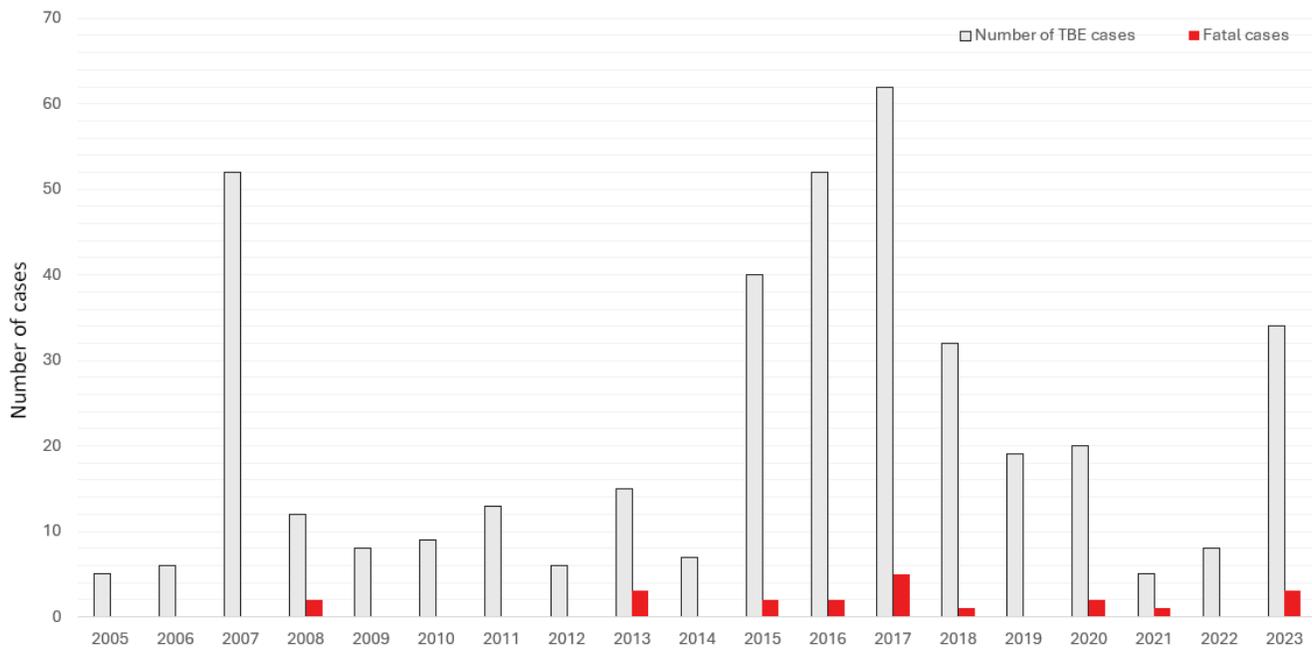
Most infections occurred among Individuals between 20–49 years of age, and it was 2.7–4.5 times higher than other age groups. Also, men more frequently contracted the disease (2.3, p<0.001) than women (Figure 2). The majority of subjects were bitten by ticks when they had been collecting plants and picnicking during May and June.⁷

According survey of long-term neurological symptoms in TBE recovered people of Selenge province. In survey, 37 people who recovered TBE were participated. 16.1(5) % of fever form, 19.4 (6)% of paralysis form, 25.8 (8)% of meningoencephalitis and 38.7 (12)% of them meningitis form when they were ill. After recovery between one to twelve years, 78.4% of them having headache, 30-40% of them having fatigue, forgetfulness, decrease ability to concentrate and stiff neck, 10-20% of them hearing loss, paralysis, small percentage (3.2%) of them remained mental change, shoulder muscle atrophy, back muscle tone and muscle tremors convulsions.²⁴

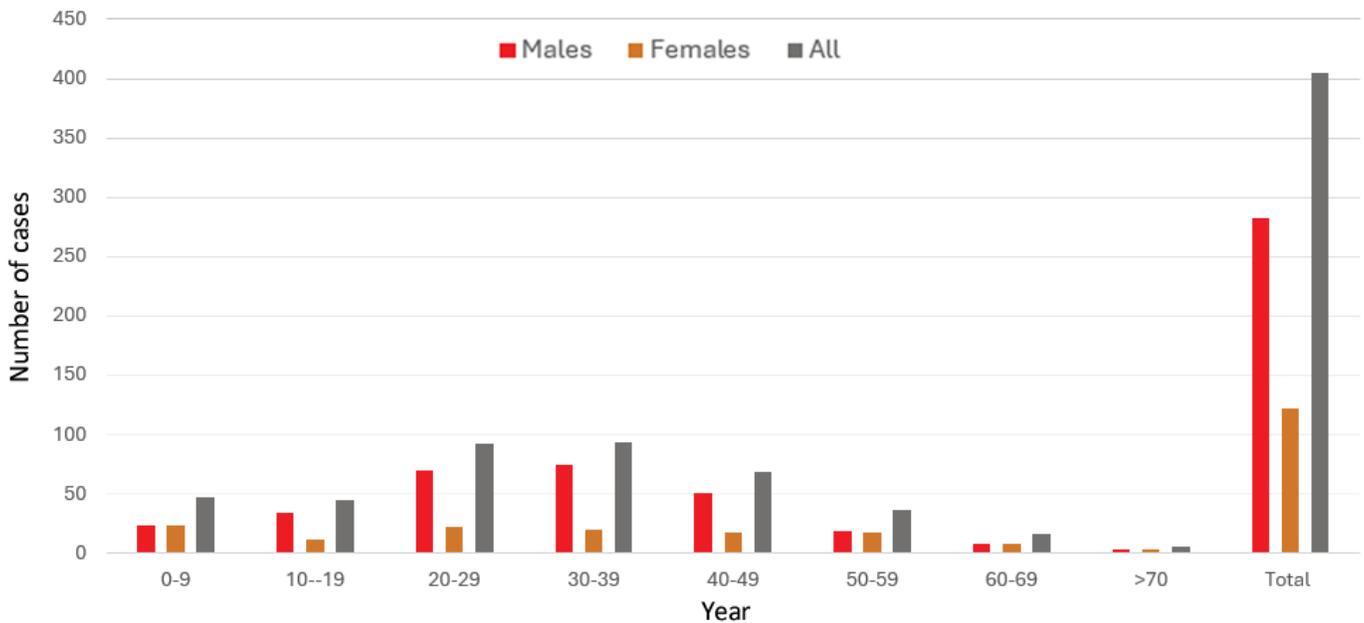
Vaccination against TBE has been consistently carried out since 2005 in the risk areas of the country.¹³⁻¹⁵ A molecular biological study of TBEV was performed in collaboration with researchers from Germany and Russia and determined the prevalent viral subtypes by genetic sequencing.^{7,15-20,22}

Overview of TBE in Mongolia

Table 1: TBE in Mongolia	
Viral subtypes, distribution ^{8,16-21}	Far Eastern subtype isolated from fatal cases Siberian subtype isolated from <i>I. persulcatus</i>
Reservoir animals	Not documented
Infected tick species (%) ^{7,8}	<i>I. persulcatus</i> (3.18 ± 2.5%) <i>D. silvarum</i> (2.9 ± 2.6%) <i>D. nuttalli</i> (0.6%)
Dairy product transmission	Not reported
Mandatory TBE reporting	Patients with clinical suspected TBE are reported to the National Center for Zoonotic Diseases (NCZD) where the diagnosis can be microbiologically confirmed (anti-TBEV-IgG and IgM by ELISA). Any patient with serologically confirmed TBE or by PCR is reported to the Center for Health Development and also to the Ministry of Health, Mongolia (Source: http://hdc.gov.mn/)
Other TBE surveillance	National Center for Zoonotic Diseases and its local branches (15 Centers for zoonotic diseases in provinces) are conducting TBE surveillance in ticks in the population of endemic areas. ^{4,6,9,10,11}
Special clinical features	Clinically, 37.7% of patients have fever only, 34.6% suffer from meningitis, 26.5% from meningoencephalitis and 1.2% from encephalomyelitis. By age, fever dominates in age groups 0–9 and 40–49 years, meningitis in the age groups of 10–39 and 50–59 years and meningoencephalitis in those >60 years. ^{7,11,12} In terms of age and sex, 20–49 year olds (65.6%) and males (69.3%) are the most affected groups. Among all affected males, those aged 10–49 years (81.8%) comprised the majority of male cases. ^{7,8} The overall CFR was 4.85% between 2005 and 2022 with an annual range between 3.1%–20%.
Available vaccines	Russian vaccine - EnceVir and TBE-Moscow.
Vaccination recommendations and reimbursement	Persons in a risk population of most endemic provinces can receive TBE vaccination free of personal charge. Vaccination is also recommended for anybody living in or visiting known endemic areas with a risk for tick bites. (Source: <i>The Order A160 on 21 April 2017 approved by the Minister of Health Annex 4: Guidelines for prevention and control of tick-borne diseases</i>)
Vaccine uptake by age group/risk group/general population	TBE vaccination is organized since 2005. As of 2017, 51,000 persons from 13 provinces and the capital have been vaccinated, i.e., 2.1% of the total population. Vaccine uptake in endemic provinces ranges between 0.2%–23%. ¹³⁻¹⁵
Name, address/website of TBE NRC	National Center for Zoonotic Diseases, Songinokhairkhan District, 20 khoroo, Ulaanbaatar, 18131, Mongolia (Source: www.nczd.gov.mn)

Figure 1: Reported TBE cases in Mongolia 2005-2023 (n=405).*(last edited in May 2025, update for 2024: no data)*

Source data: Appendix - Figure 1

Figure 2: Age and gender distribution of TBE in Mongolia (2005–2023, n=405)

Source data: Appendix - Figure 2

Table 3: TBEV-isolation and TBE cases in Mongolia

Year of isolation	Strain name	Source of isolation	Location of isolation
2004 ¹⁹	Siberian	<i>I. persulcatus</i>	Selenge province
2008 ¹⁶	Far-Eastern	Patient brain	Bulgan province
2010 ¹⁵	Siberian	<i>I. persulcatus</i>	Bulgan province
2012 ¹⁷	Siberian	<i>I. persulcatus</i>	Selenge province
2013 ¹⁷	Siberian	<i>I. persulcatus</i>	Selenge province
2014 ²⁰	Siberian	<i>I. persulcatus</i>	Selenge province
2020 ²²	Far-Eastern	Patient brain	Bulgan province

57% of TBE cases (incidence 9.51/100,000) occurred in the forest-taiga range, 40% (incidence 0.56/100,000) in the forest-steppe range, 0.7% (incidence 0.12/100,000) in steppe range, and 2.8% (incidence 0.1–0.27/100,000) in other ranges, including steppe-desert, Gobi and high mountain (Figure 3).

According to the surveillance efforts since 2006, 10,464 ticks were collected. Following species identification, 14.7% (1,540) were classified as *Ixodes persulcatus*, 79.3% (8,300) were *Dermacenter nutalli*, 3.2% (341) were *Dermacenter silvarum*, and 2.8% (283) were *Hyalomma asiaticum*.⁸

I. persulcatus ticks were collected from 13 districts of Selenge, Bulgan, Orkhon, Darkhan-Uul, Khentii and Khuvsgul provinces. Most cases were found in Selenge

(66%) and Bulgan (23%) provinces. The total tick infection rate was $3.18 \pm 2.5\%$ and the highest infection rates were found in Bugat district of Bulgan Province (7.5%) and in the Mandal district (6.3%) and Khuder district (3.75%) of Selenge province.

D. nuttalli ticks were collected from 43 districts of 12 provinces and Ulaanbaatar city. The total tick infection rate for the entire country was 0.61% with the highest infection rates (3.3–7.8) in Khentii, Selenge, Arkhangai and Dornod province.

D. silvarum ticks were collected from Dornod and Khentii provinces and the tick infection rate was $2.9 \pm 2.6\%$ (Figure 4).

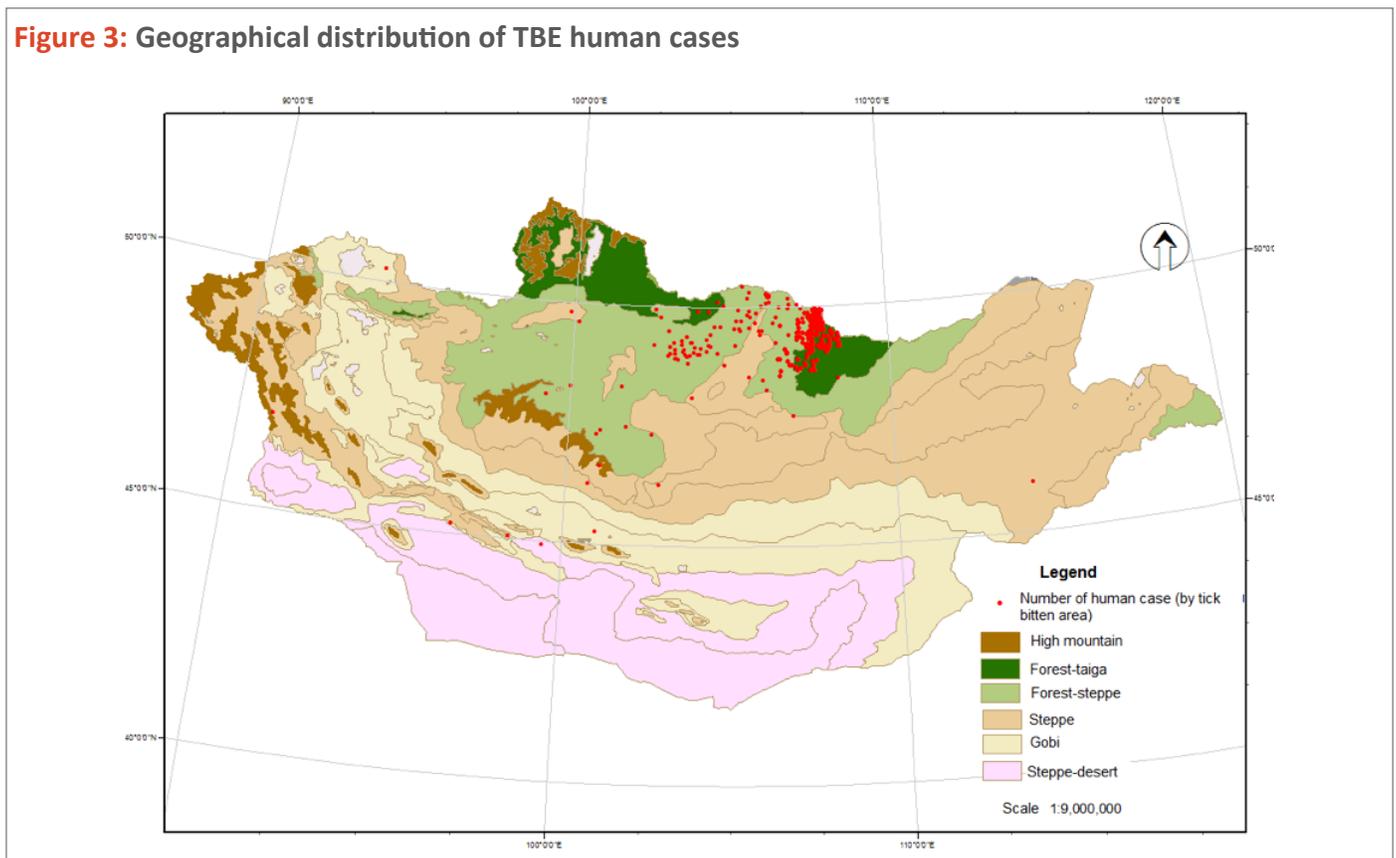
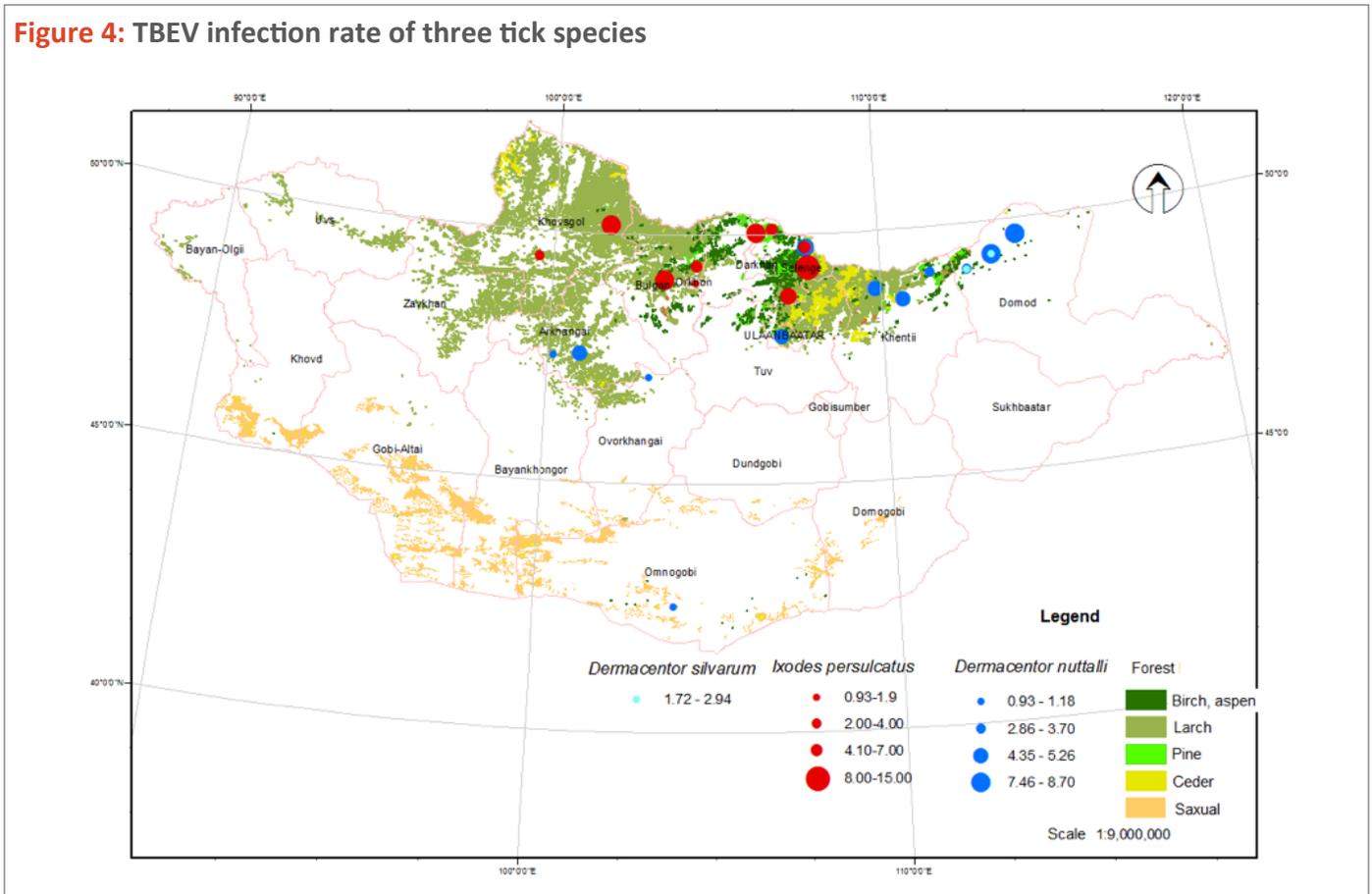
Figure 3: Geographical distribution of TBE human cases

Figure 4: TBEV infection rate of three tick species



Appendix

Source data: Figure 1

Year	Number of cases	Fatal cases	Incidence/10 ⁵
2005	5	0	0.21
2006	6	0	0.23
2007	52	0	2.06
2008	12	2	0.47
2009	8	0	0.3
2010	9	0	0.33
2011	13	0	0.46
2012	6	0	0.21
2013	15	3	0.5
2014	7	0	0.23
2015	40	2	1.33
2016	52	2	1.8
2017	62	5	2.0
2018	32	1	0.97
2019	19	0	0.57
2020	20	2	0.60
2021	5	1	0.15
2022	8	0	0.23
2023	34	3	0.98

Source data: Figure 2

Age group (years)	Males	Females	All
0-9	24	23	47
10-19	34	11	45
20-29	70	22	92
30-39	74	20	94
40-49	51	17	68
50-59	19	18	37
60-69	8	8	16
≥70	3	3	6
Total	283	122	405

Contact: dnorov09@gmail.com

Citation:

Damdindorj T, Baasandagva U, Narankhuu U, Nyamdorj T, Badrakh B, Khoroljav B. TBE in Mongolia. Chapter 13. In: Dobler G, Erber W, Bröker M, Chitimia-Dobler L, Schmitt HJ, eds. *The TBE Book*. 7th ed. Singapore: Global Health Press; 2024. doi:10.33442/26613980_13-22-7

References

- Bataa J, Abmed D. Tick-borne diseases Handbook. Ulaanbaatar, Mongolia. 2007:20-25.
- Dash M, Byambaa B, Trasevich IV. Handbook of New rickettsial diseases. Ulaanbaatar, Mongolia: Ma: Esun Erdene press; 1994:9.
- Wikipedia contributors. *Ixodes persulcatus*. Wikipedia, The Free Encyclopedia. April 10, 2021, at 21:59 UTC. Available at: https://en.wikipedia.org/wiki/Ixodes_persulcatus. Accessed June 1, 2016
- Abmed D, Bataa J, Tserennorov N, et al. Natural foci of transmissible tick-borne infections in northern and central Mongolia. Actual aspects of natural focal diseases. Materials of the interregional scientific-practical conference, Omsk. 2001:23.
- Abmed D, Ganbold D, Andreev VN, Lvov S, Dmitriev DB. The study of tick-borne encephalitis in Selenge aimag (province). *The Center for Research of infectious diseases with natural foci, research book*. 1990;(6):67-69.
- Veteran doctor D. Renchenkhand's memoirs. *Mongolian Journal of infectious disease research*. 2018;3(80):74-75.
- Uyanga B. Epidemiological characteristics and prevalence of tick-borne encephalitis in Mongolia 2005-2017. *Dissertation*. 2019.
- Uyanga B, Burmaajav B, Tserennorov D, et al. Geographical distribution of Tick-borne encephalitis and its vector in Mongolia, 2005-2016. *Central Asian Journal of medical sciences*. 2017;3(3):250-258.
- Uyanga B, Tserennorov D, Badrakh B, Damdin O, Baatar U, Tsogbadrakh N. The becoming importance species of *Dermacentor.spp* tick in tick-borne encephalitis of Mongolia. 16th Medical Biodefense Conference Munich, 28—31 October, 2018 organized by Bundeswehr Institute of Microbiology ABSTRACTS –P. 111
- Uyanga B, Burmaajav B, Tserennorov D, Undraa B. Epidemiological features of tick-borne encephalitis registered in Mongolia, 2005-2016. *Mongolian Journal of infectious disease research*. 2017;5(76):36-41.
- Uyanga B, Tserennorov D, Purevdulam L, Tsogbadrakh N. Tick-borne encephalitis in Mongolia. *Mong J Infect Dis Res*. 2015;5(64):13-34.
- Tserennorov D, Uyanga B, Battsetseg J, Bayar C, Baigalmaa B, Njamsuren M. Results of a study of tick-borne encephalitis and analysis of human cases in Mongolia. *Far Eastern Journal of Infectious Pathology (Medical Scientific Review Journal)*. 2014;25:36-39.
- Uyanga B, Unursaikhan U, Undraa B, Tsogtsaikhan S, Davaalkham D. Epidemiological characteristics of tick-borne encephalitis and vaccination results. *J Infect Pathol*. 2012;19(3):114
- Uyanga B, Adiyasuren Z, Tsogtsaikhan S, Davaalkham D. Results of tick-borne encephalitis vaccination. *J Mong Med Sci*. 2010;3(153):64-70.
- Bataa J, Abmed D, Tsend N, et al. Results of immunization against tick-borne encephalitis in Mongolia. *Biotechnical research, production and use*. 2004:20-24.
- Frey S, Mossbrugger I, Altantuul D, et al. Isolation, preliminary characterization, and full-genome analyses of tick-borne encephalitis virus from Mongolia. *Virus Genes*. 2012;45(3):413-425
- Khasnatinov MA, Danchinova GA, Kulakova NV, et al. Genetic characteristics of the causative agent of tick-borne encephalitis in Mongolia. *Vopr Virusol*. 2010;55(3):27-32.
- Tserennorov D, Höper D, Binder K, et al. Epidemiological and Molecular Biological Characterization of TBEV in Mongolia. 15th Medical Biodefence Conference, Munich, Germany. 2016:30-31
- Tserennorov D, Uyanga B, et al. Study of Tick-borne Encephalitis Virus in Mongolia. 14th Medical Biodefence Conference, Munich, Germany. 2013:29-30
- Abmed D, Khasnatinov M, Bataa J, et al. Molecular, epidemiological, ecological study of tick-borne encephalitis virus in Mongolia. *Mong J Infect Dis Res*. 2005;4(7):22-5.
- Erdenechimeg D, Boldbaatar B, Enhmandakh Y, Myagmarsukh Y, Oyunnomin N, Purevtseren B. Identification of the Siberian type of the tick-borne encephalitis virus and serological surveillance in Mongolia. *Mong J Agric Sci*. 2014;13(2):19-26.
- Walder G, Lkhamsuren E, Shagdar A, et al. Serological evidence for tick-borne encephalitis, borreliosis, and human granulocytic anaplasmosis in Mongolia. *Int J Med Microbiol*. 2006;296 Suppl 40:69-75.
- Uyanga B, Burmaajav B, Natsagdorj B, et al. A case series of fatal meningoencephalitis in Mongolia: epidemiological and molecular characteristics of tick-borne encephalitis virus. *Western Pacific Surveillance and Response Journal*. 2019;10(1):1-7. doi: 10.5365/wpsar.2018.9.1.003
- Uyanga B, Oyun B, Oyunchimeg S, Ganzorig G, Rolomjav L, Erdenebat N, et al. Long-term neurological outcome of tick-borne encephalitis in Mongolia. *Mong J Infect Dis Res*. 2021;4(99):78/28