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INTRODUCTION

Tick-borne encephalitis virus (TBEV) is a member of the genus *Flavivirus* within the family *Flaviviridae* and one of the most important tick-borne diseases in human medicine in Europe. The virus is spread over a wide area of the Eurasian continent. In Germany, it is mainly transmitted by *Ixodes (I.) ricinus* with mainly southern federal states considered as high-risk areas in human medicine (Fig. 1).^{1,2}

AIMS OF THE STUDY

The main objective of this retrospective study was to assess the incidence and regional distribution of TBEV in horses in Germany.

MATERIAL AND METHODS

This retrospective study included test results of direct (PCR) and indirect detection methods (IgG-all species-ELISA) for TBEV from horses requested by German veterinarians from January 2010 to December 2021. Additionally, an IgM-ELISA was available from June 2019 onwards. The samples were analyzed by the laboratory LABOKLIN (Bad Kissingen, Germany). The veterinarians were contacted by phone asking for clinical signs of the tested horses. Descriptive statistical analysis was carried out using SPSS (Windows, Version 28.0, SPSS Inc., USA).

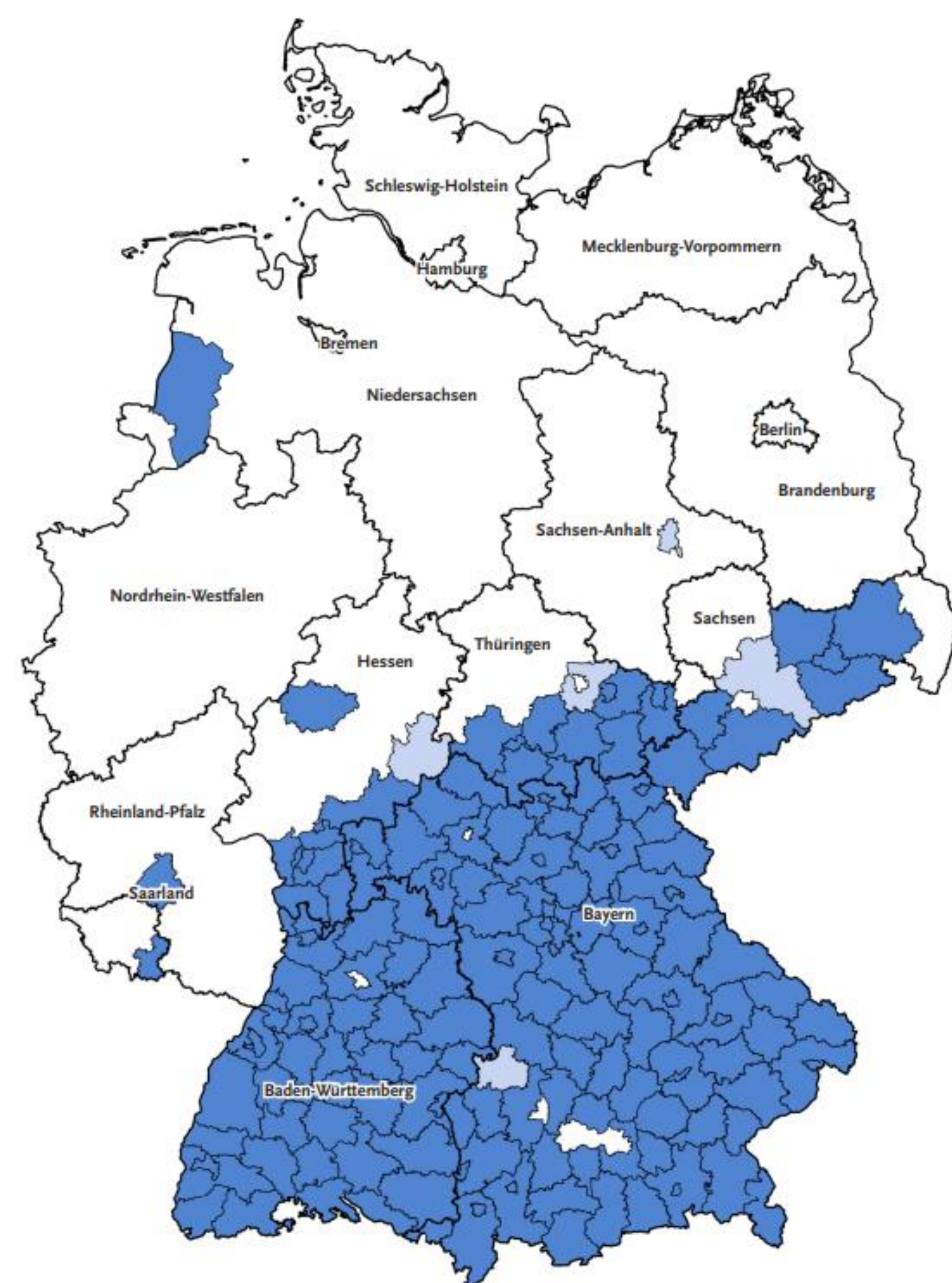


Figure 1: High-risk areas in Germany based on TBEV-infections in human medicine between 2002 and 2020 (marked in blue)³

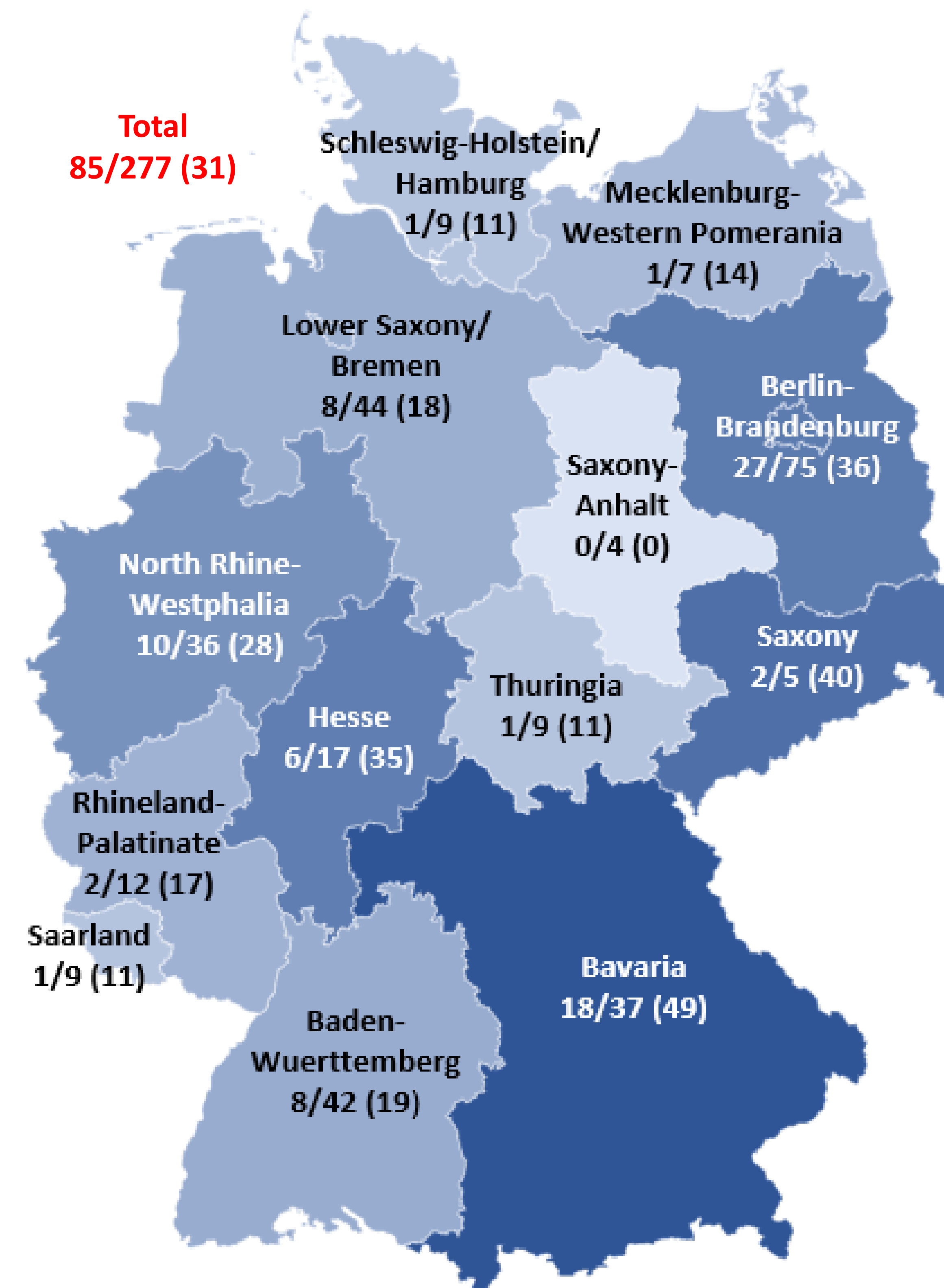


Figure 2: Incidence of positive test results for TBEV in horses (IgG/IgM-antibody-testing) living in Germany from 2010 to 2021 (*n* tested positive/*N* total (%))

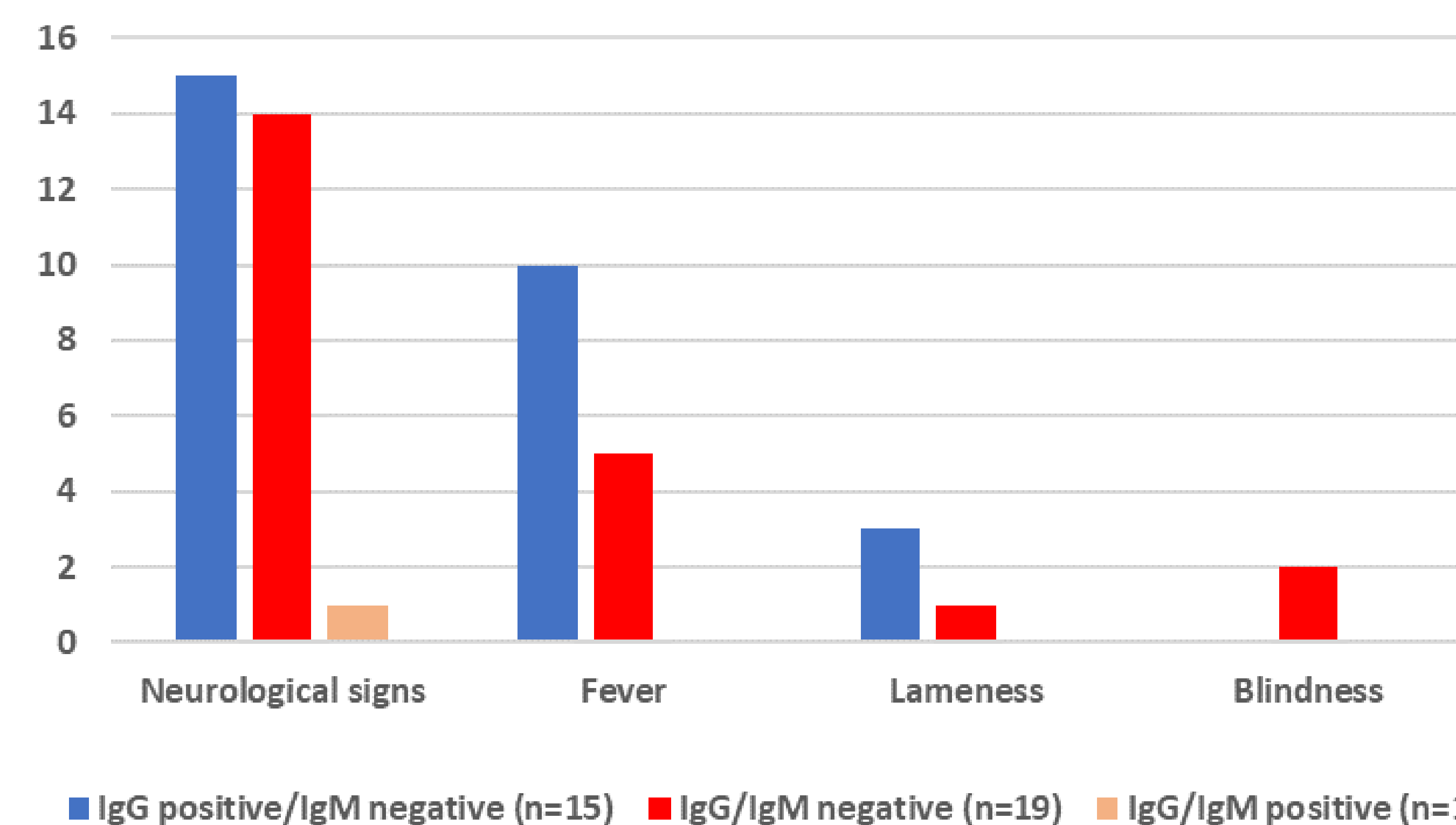


Figure 3: Clinical signs in 35/277 horses (13%) tested serologically for TBEV via IgG- and/or IgM-antibody testing

RESULTS

In total, 306 horses were tested by PCR and/or antibody-testing. None out of the 37 horses were tested positive by PCR. Eighty-five out of 277 horses (31%) were tested seropositive (81 out of 266 (30%) for IgG- and 9/217 (4%) for IgM-antibodies). Taking federal states with at least 10 tested horses in consideration, the highest amounts of horses tested serologically positive were in Bavaria (49%), Hesse (46%) and Berlin-Brandenburg (36%) (Fig. 2). Nine horses were tested positive for IgM-antibodies in Bavaria (*n*=2), Baden-Württemberg (*n*=2), North-Rhine-Westphalia (*n*=2), the Saarland, Berlin-Brandenburg and Lower Saxony (*n*=1 each) from 06/2019 onwards. Positive IgM-results were detected in June and July (*n*=2, each), March, August, September, October and December (*n*=1, each). Neurological signs and fever were the most common clinical abnormalities in 35/277 serologically tested horses (13%) (Fig. 3).

Discussion

Eighty-five out of 277 horses (31%) were seropositive for TBEV. The majority of IgM-positive tested horses were detected in summer and autumn, comparable to humans.³ The highest activity of *I. ricinus* is reported in spring and summer in Germany⁴, possibly explaining the positive IgM-results in 7/9 horses from June to October. Neurological signs and fever were recognized as the most common clinical signs. These are considered as typical for TBEV-infections⁵, but were seen in positive and negative tested horses. Horses most often show no or only mild clinical signs⁵, therefore the prevalence may even be higher than reported. Highest incidences were recognized in horses from southern federal states as well as Berlin-Brandenburg (Figure 2). Bavaria, Saxony and parts of Hesse are considered as high-risk areas in human medicine (Fig. 1), whereas Berlin-Brandenburg and North-Rhine Westphalia so far are not.³ Especially in Berlin-Brandenburg and Saxony, cross-reactions with West Nile Virus have to be taken in consideration.

Limitations

Limitations of our study are the low number of serological and PCR tests performed, the retrospective design, possibility of cross reactions with other viral diseases and limited clinical data.

Conclusion

This study represents the first report of incidences of TBEV in horses throughout Germany. TBEV-infections should be considered as differential diagnosis in horses with neurological signs and fever. Prospective serological surveys using neutralization tests are needed to gain more specific data. High numbers of serologically positive tested horses and the regional/seasonal distribution seen indicate the need for larger studies. Evaluation of clinical data would be desirable.

REFERENCES

- ¹Suss J. Tick-borne encephalitis 2010: Epidemiology, risk areas, and virus strains in Europe and Asia-An overview. *Ticks Tick-Borne Dis.* 2011, 2 1:2-15; ²Mansfield KL, Johnson N, Phipps LP, et al. Tick-borne encephalitis virus - a review of an emerging zoonosis. *J Gen Virol.* 2009, 90 Pt 8:1781-94; ³Robert Koch Institut. Risikogebiete der Frühsommer-Meningoenzephalitis (FSME) in Deutschland. *Epid Bull.* 2021, 9:3-20 (in German); ⁴Gethmann J, Hoffmann B, Kasbohm E, et al. Research paper on abiotic factors and their influence on *Ixodes ricinus* activity-observations over a two-year period at several tick collection sites in Germany. *Parasitol Res* 2020, 119(5): 1455-1466; ⁵Klaus C, Hoffmann D, Hoffmann B, et al. Tick-borne encephalitis virus infections in animals - clinical symptoms, diagnostics and epidemiologic relevance. *Berl Munch Tierarztl* 2017; 130:102-112.