

Equine zoonoses in Central Europe: A systematic review of research trends and circulating zoonotic agents

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1 Introduction

For centuries, horses have been essential to human societies, particularly in regions where they are vital for transport and livelihoods. Domesticated (e.g., horses, donkeys, and mules) and wild or captive (e.g., zebras) equids also pose zoonotic risks. Zoonotic equid diseases, spread through direct or indirect contact, pose a higher risk to individuals working with or engaging in leisure activities involving equids.

2 Aims of the study

- Examine zoonotic pathogens reported in equids across the Central Europe;
- Analyze regional research trends related to zoonotic agents in equids;
- Identify circulating equine zoonotic agents in the region;
- Explore collaborative patterns among authors and countries in this field.

3 Methods

We conducted a systematic literature search following PRISMA guidelines to identify publications on naturally occurring zoonotic pathogens of equids from nine countries: Austria, Czech Republic, Germany, Hungary, Italy, Liechtenstein, Slovakia, Slovenia, and Switzerland. We searched three databases—PubMed, Scopus, and CABI—yielding 1,435 publications, of which 256 were included in the review, spanning 58 years of research (1964–2022).

4 Results

A. Research trends

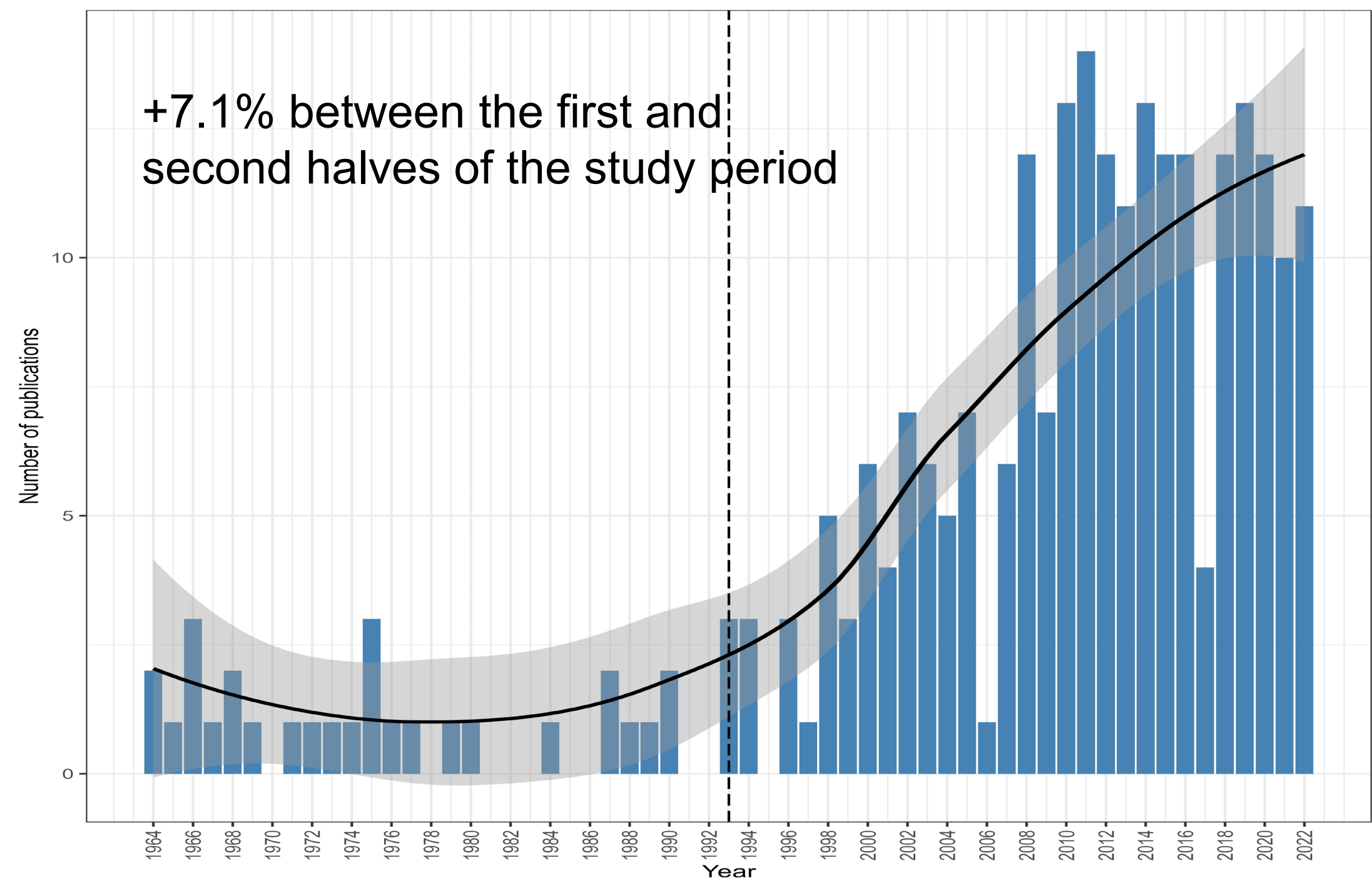


Figure 1: Annual number of publications on zoonotic diseases of equids conducted in nine countries of Central Europe, 1964-2022.

B. Investigated prioritised pathogens across countries

Overall, 191 zoonotic agent taxa were investigated, with the top 10 most studied pathogens accounting for 60.2% of the included literature.

Most frequently studied species: *Equus caballus* (horse, n=245 publications), followed by *Equus asinus* (ass, 30).

Less commonly investigated equids: *Equus quagga chapmani* (Chapman's Zebra), *Equus przewalskii* (Przewalski's horse), *Equus asinus somalicus* (Somali Wild Ass), *Equus asinus* x *Equus caballus* (mule), *Equus grevyi* (Grevy's Zebra), *Equus hemionus kulan* (Kulan), *Equus kiang* (Tibetan Wild Ass), *Equus quagga boehmi* (Grant's Zebra), *Equus quagga borensis* (Selous' Zebra), *Equus quagga burchellii* (Burchell's Zebra), *Equus zebra hartmannae* (Hartmann's Mountain Zebra), and zebra (scientific name not specified).

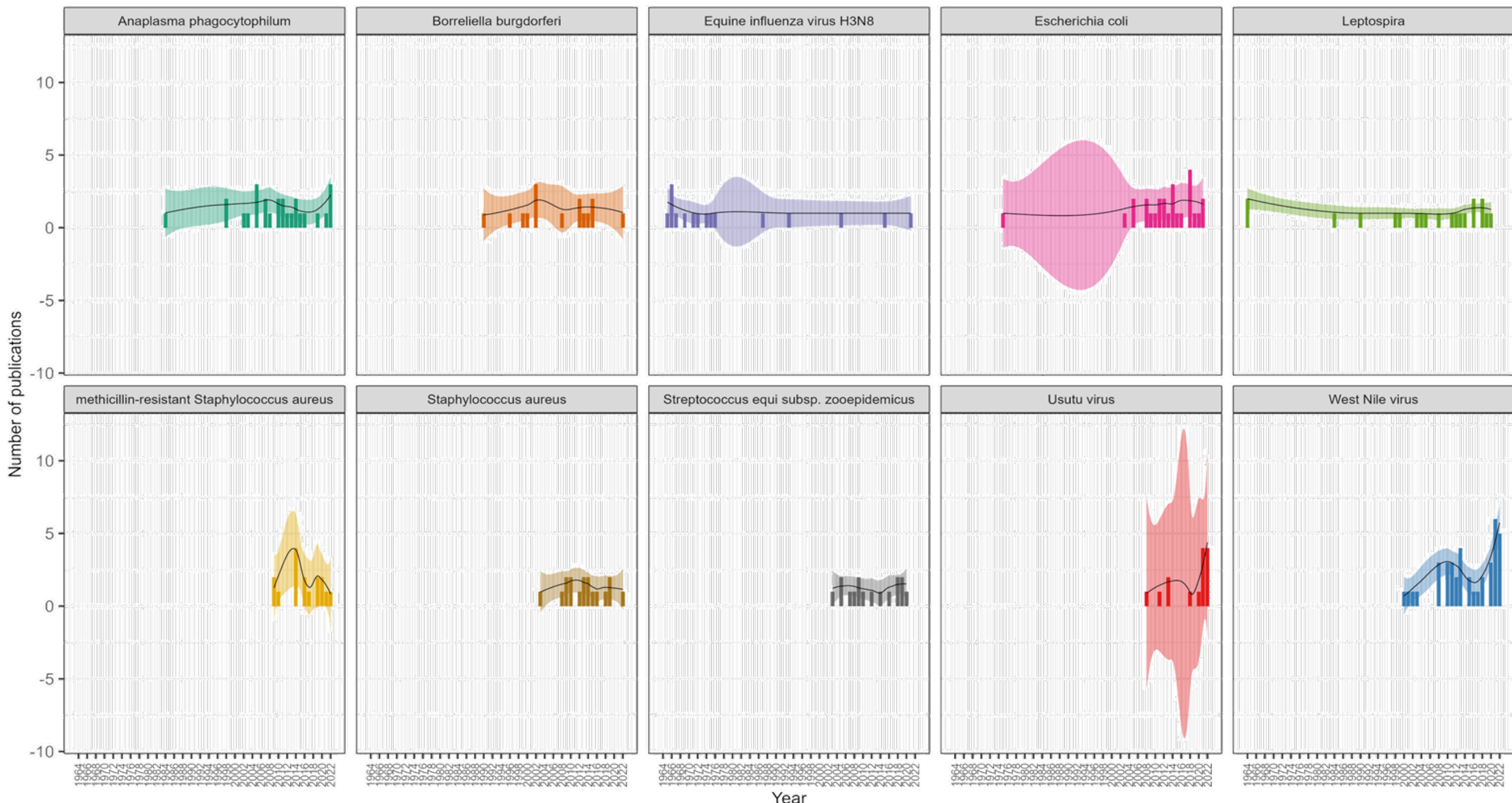


Figure 2: Top 10 most studied zoonotic agents of equids in nine central European countries, 1964-2022.

C. Circulating zoonotic agents of equids in Central Europe

- 183 zoonotic taxa were identified: 145 (79.2%) bacteria, 29 (15.8%) eukaryotes, and 9 (4.9%) viruses.
- Italy reported the largest number of equine zoonotic agents (89), followed by Germany (88), and Czech Republic (57).
- 34 newly identified genera compared to previous list (Sack *et al.*, 2020)

Country of study	Bacteria	Eukaryota	Viruses
Austria	22	2	4
Czech Republic	49	7	1
Germany	63	16	9
Hungary	14	1	3
Italy	67	19	3
Slovakia	26	0	3
Slovenia	1	0	1
Switzerland	32	6	2

Table 1. Distribution of identified zoonotic pathogens of equids by superkingdom across nine central European countries, 1964-2022.

D. Shared circulating zoonotic agents



Figure 3: Distribution of shared circulating zoonotic agents of equids across nine central European countries, 1964-2022.

E. Collaboration network

1,233 researchers from 24 countries, organised into nine research communities, collaborated on equine zoonotic diseases in this region, with Germany, Italy, Czech Republic, and the USA playing pivotal roles in the research network.

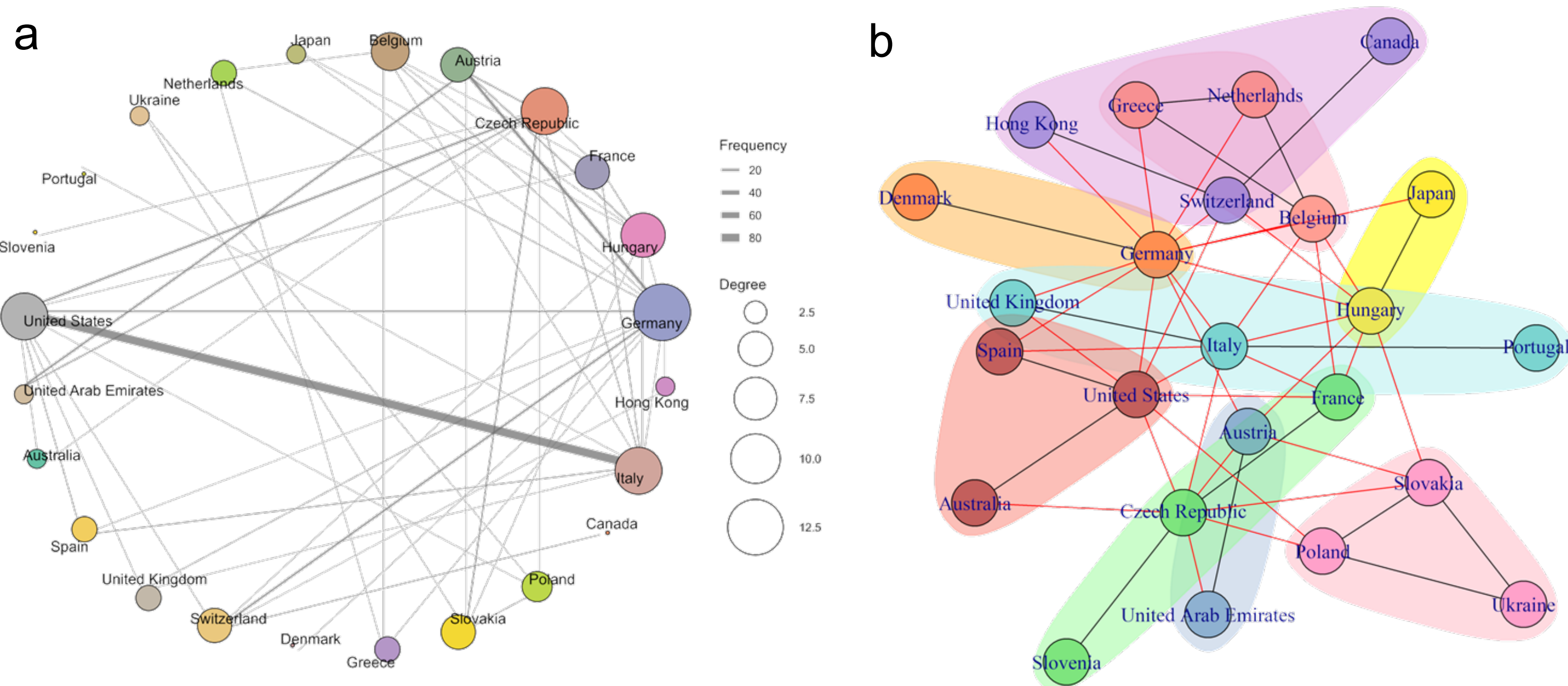


Figure 4: Multinational collaboration network on zoonotic equid diseases, Central Europe, 1964-2022. (a) Edge width indicates collaboration frequency, and node colours represent country clusters detected by the Leiden algorithm. (b) Node colour indicates communities detected using the Leiden algorithm, reflecting groups of countries that collaborated more frequently with each other than with countries. Red edges show collaborations between clusters, while black edges represent collaborations within the same cluster.

5 Conclusion

- This study provides a thorough examination of zoonotic diseases in equids, reflecting the growing awareness of associated risks, with a notable focus on West Nile virus.
- We evidenced a rise in research interest for emerging and vector-borne zoonoses.
- Collaborative research efforts are strongly shaped by geographic proximity, reflecting regional disease dynamics.
- The global expansion of equine sports increases zoonotic infection risks, posing health threats to humans.
- Continued surveillance and robust preventive measures are critical to mitigate public and animal health threats globally.

Reference: Sack A, Oladunni FS, Gonchigoo B, Chambers TM, Gray GC. Zoonotic diseases from horses: a systematic review. Vector Borne Zoonotic Dis. 2020;20(7):484-95.