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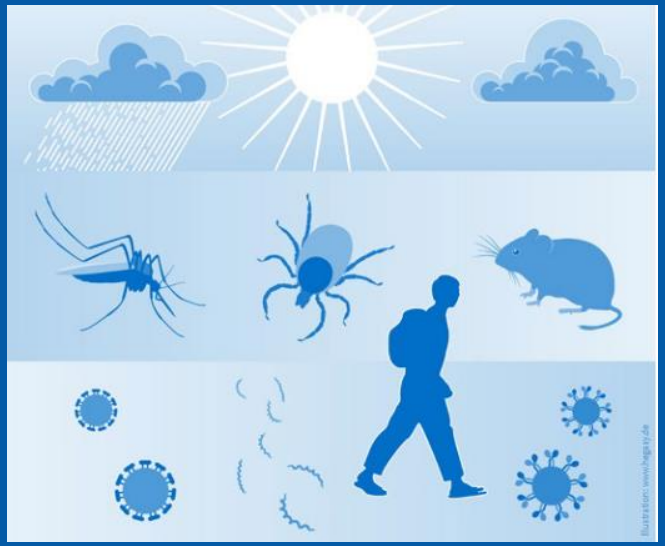

Emerging infections and climate change – influence on blood safety

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National Haemovigilance Office (NHO) Conference 2025
Dublin, March 25, 2025

Conflicts of interest

None

SoHO-relevant emerging pathogens (selection)

Pathogen	Main vector/transmission mode	Host/Reservoir
West-Nile-Virus	Culex	Birds
Denguevirus	Aedes spp	Humans, Apes
Zikavirus	Aedes spp	Humans
Chikungunyavirus	Aedes spp	Rodent, Apes, (Humans)
Krim-Kongo-Virus	Hyalomma	Livestock
Babesiosis	Ixodidae	Vertebrates, including Humans
Trypanosoma cruzi	Triatominae	Vertebrates, including Humans
Malaria	Anopheles	Humans, Apes
Mpox-Virus	Direct contact	Vertebrates (small mammals)
Marburg-Virus	Direct contact	Fruit bats

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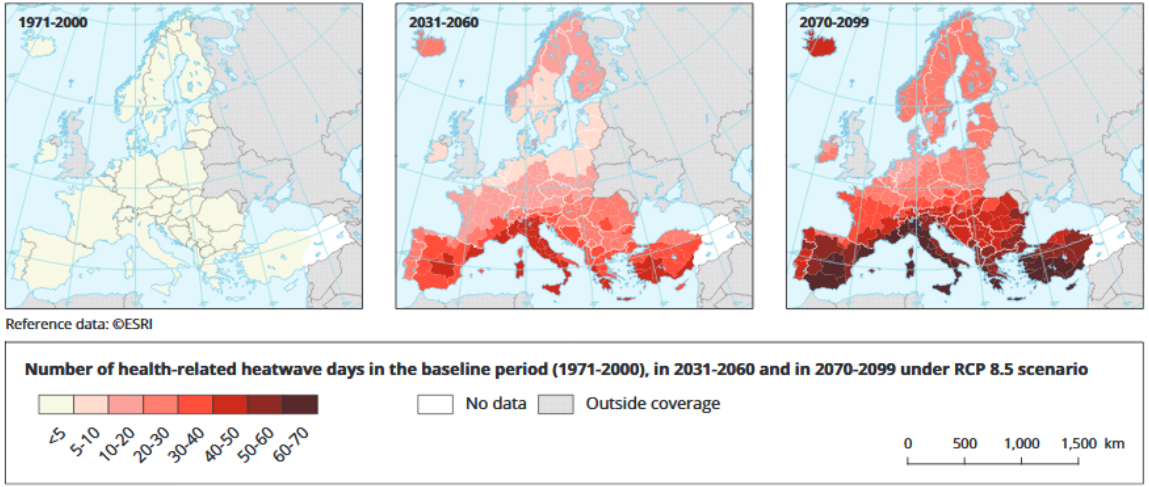
Climate change

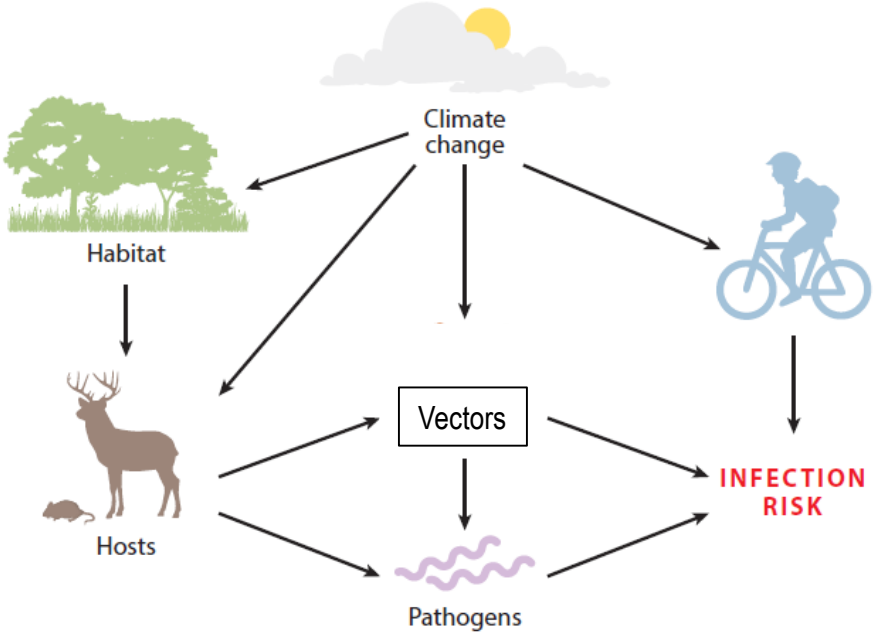
Map 3.1 **Number of health-related heatwave days in the baseline period (1971-2000), 2031-2060 and 2070-2099 under RCP 8.5 scenario**



Notes: A health-related heatwave is a period of at least two consecutive days on which the maximum apparent temperature (Tappmax) exceeds the 90th percentile of Tappmax and the minimum temperature (Tmin) exceeds the 90th percentile of Tmin. The apparent temperature is a measure of relative discomfort due to combined heat and high humidity. Health-related heatwaves are calculated for June, July and August.

Source: Climate-ADAPT (2022a).

Context



Modified from Gilbert, Ann Rev Entomol, 2021

Precipitation

Source: Stuttgarter Zeitung

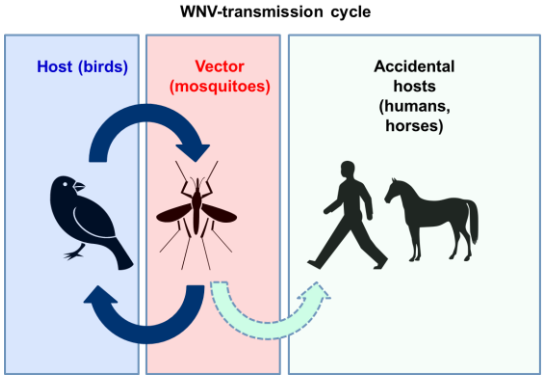
Vector control

Source: Ungarn heute

West-Nile-Virus

- WNV = Flavivirus
- Main vector: Culex spp.
- Birds are amplifying hosts, high fatality in some species
- Mammals including equines and humans are dead-end-hosts = low level viraemia
- Humans: 80% asymptomatic, 19% WNF, 1% WNND

Transmission via SoHO well documented with adverse outcome



Offergeld et al., Hämotherapie 2022

23.07.2020

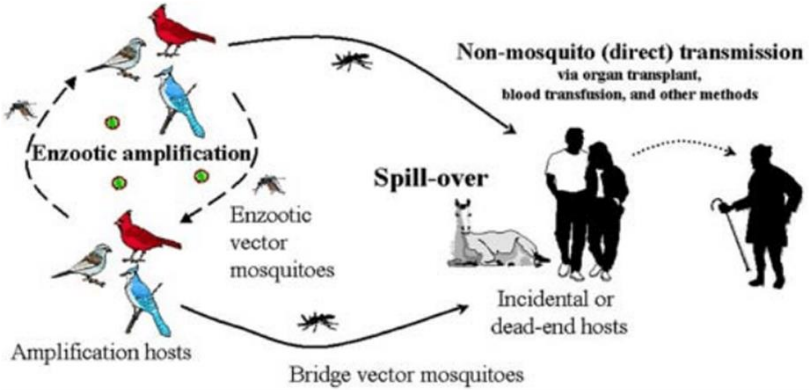
Schneeeule an West-Nil-Virus gestorben

Im Erfurter Zoopark ist eine Schneeeule an dem West-Nil-Virus gestorben, das Virus stammt ursprünglich aus Afrika. Seit 2018 gibt es auch erste Fälle in Deutschland.

WNV and climate change

- Main vector (Culex) established in Germany
- Population densitity depends on weather conditions
- Ecologically favoured regions (Wetlands)
- Continuous warm temperatures shorten incubation period of the virus in the mosquitoe and prolong transmission season

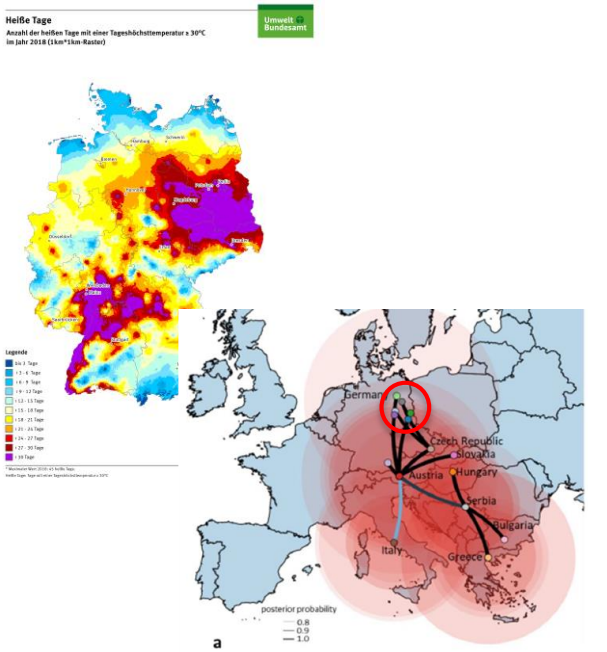
https://www.researchgate.net/project/Climate-change-and-mosquito-borne-arboviruses-an-examination-of-current-and-future-potential-range-changes-of-Culex-pipiens-in-Canada



WNV in Germany 2024

- WNV was first detected in Germany in 2018 after an unusually hot summer in the east
- Local human infections since 2019
- 10-50 human cases identified each year, mid-July-October
- Slow spread towards northern/western parts of Germany
- Blood donor screening started 2020
- Most infections identified in (asymptomatic) blood donors

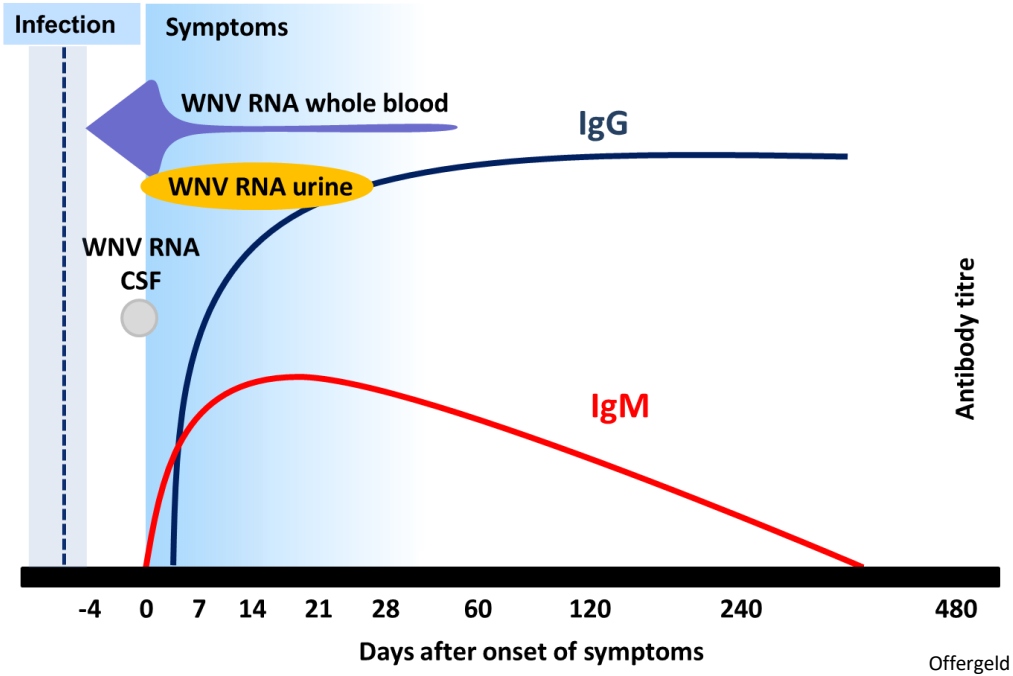
No transmissions via SoHO in Germany reported to date



Ziegler U, Santos PD, Groschup MH, et al. West Nile Virus Epidemic in Germany Triggered by Epizootic Emergence, 2019. Viruses 2020, 12, 448

https://www.fli.de/de/aktuelles/tierseuchengeschehen/west-nil-virus/ and RKI data

WNV markers of infection



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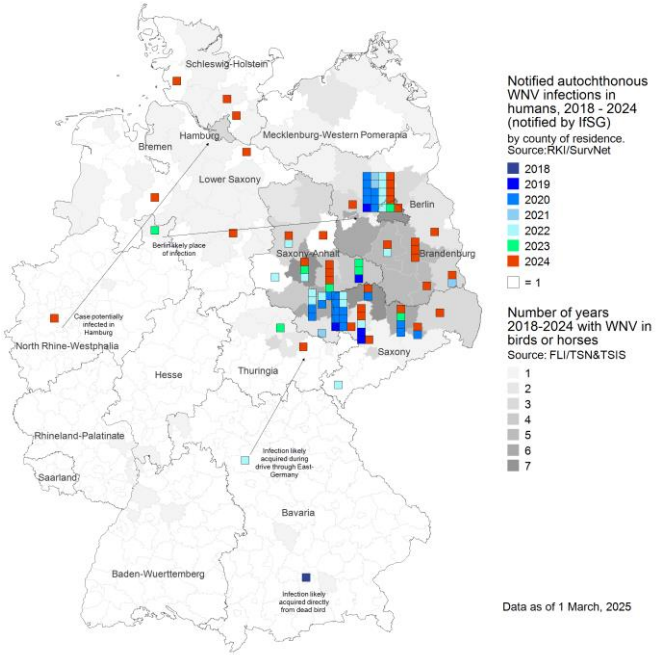
WNV testing

	Clinical case	Blood donor
Initial test	NAT (plasma, whole blood, urine, CSF) WNV-IgM	WNV-NAT (LoD: 120 copies/mL relating to the single donation)
Confirmation/follow up	WNV IgG titre increase WNV IgM titre increase Specific NAT for WNV and USUV, respectively Next generation sequencing	Specific NAT for WNV and USUV, respectively Next generation sequencing
CSF: cerebrospinal fluid		

WNV testing in blood donors 2024

2.3 million donations tested
92 initially reactive blood donations

32 WNV	**(35%)**
18 USUV	(20%)
27 no virus detected	(29%)
15 inconsistent results	(16%)

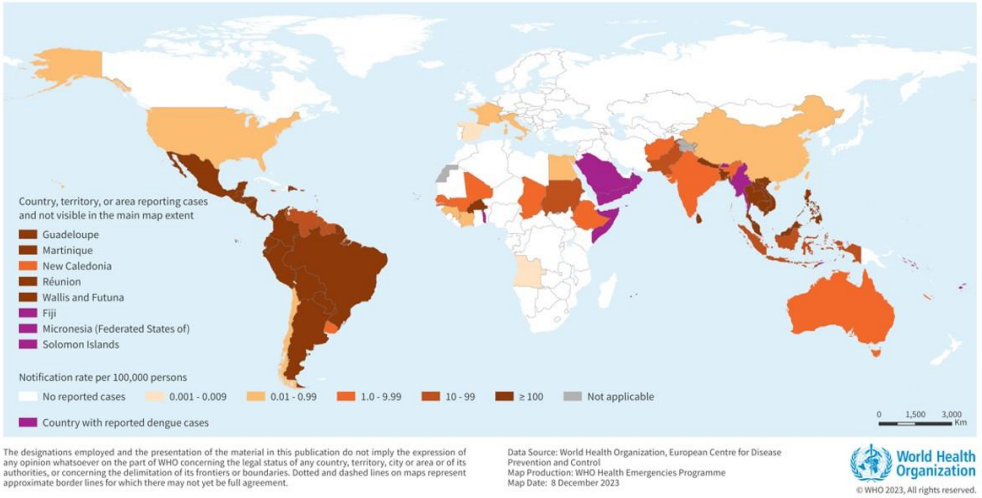


Dengue-Virus

- DENV = Flavivirus
- Main vector: Aedes aegypti (Aedes albopictus)
- 90% asymptomatic or with mild symptoms, 10% severe symptoms, haemorrhagic fever possible after infection with a different serotype

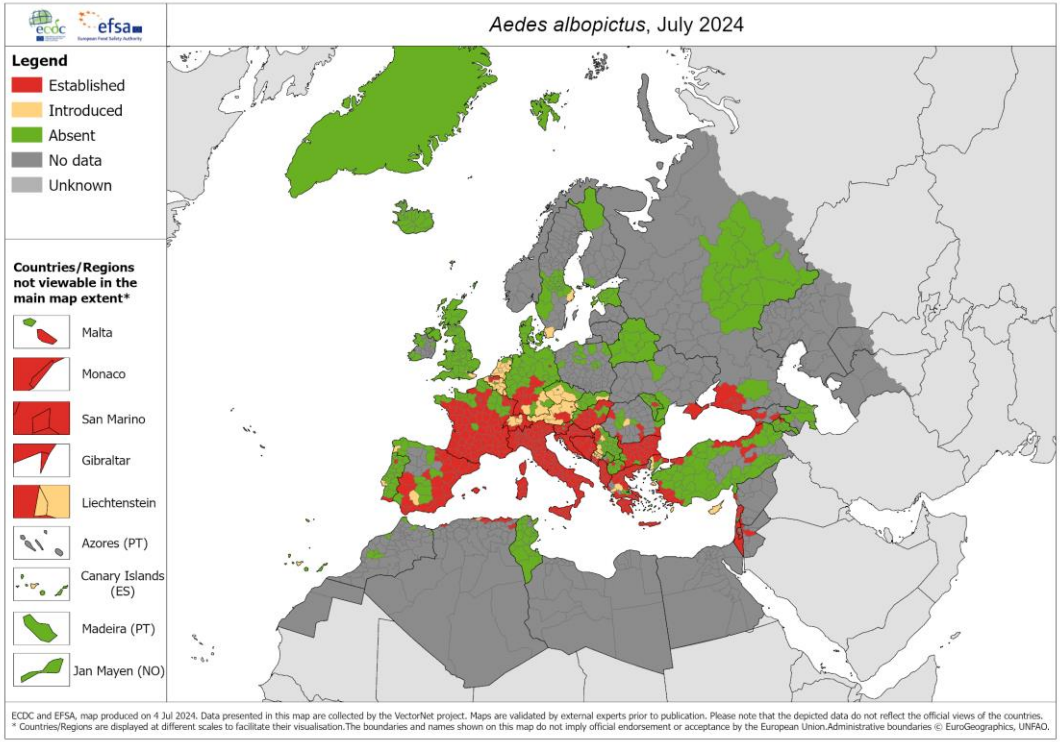
Transmission via SoHO occasionally documented with adverse outcome

Countries/territories/areas reporting autochthonous dengue cases (November 2022- November 2023)



Vector travelling

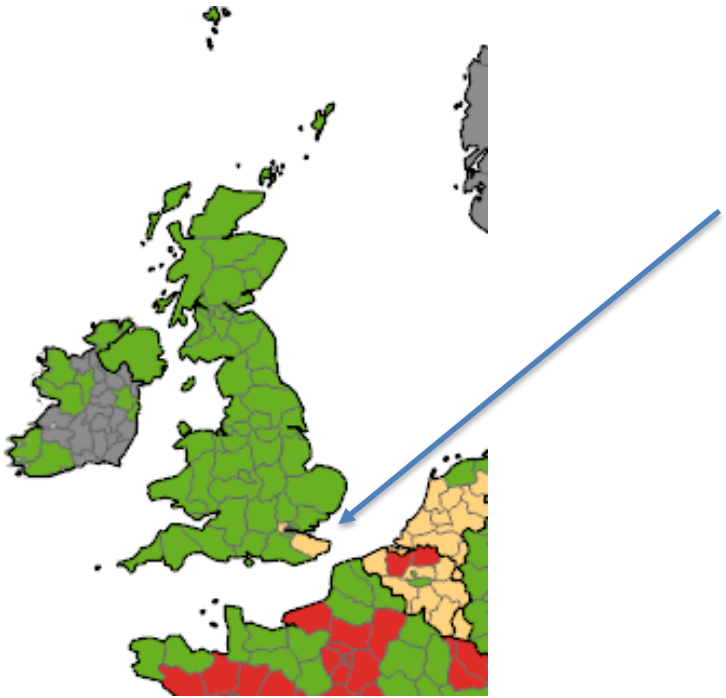
Aedes albopictus current distribution



Competent vector for

- **Denguevirus**
- Chikungunyavirus
- Zikavirus
- …

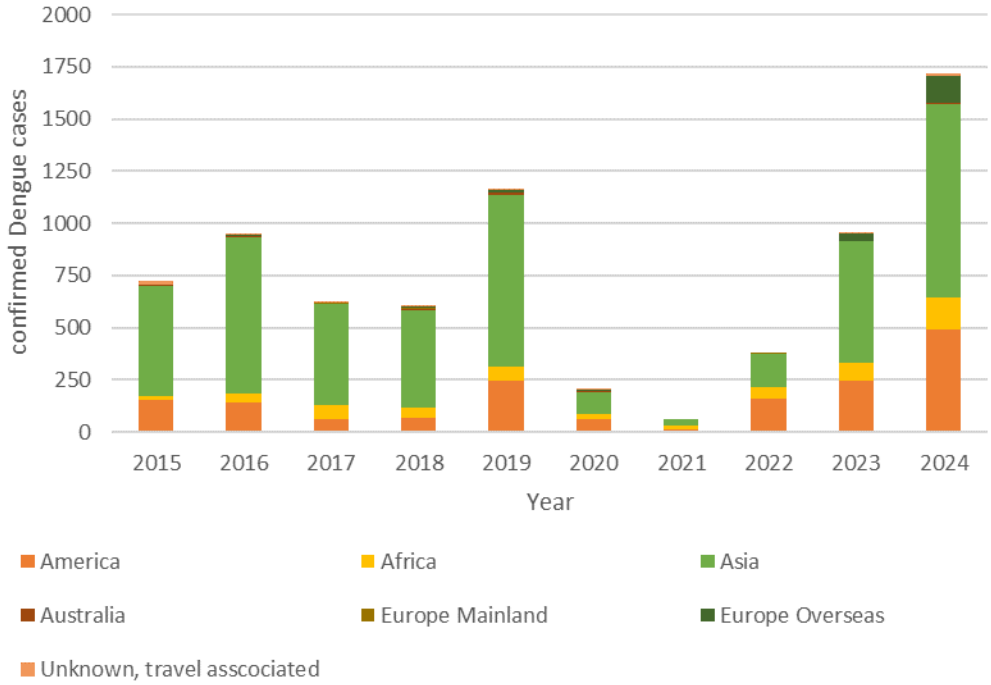
Aedes albopictus in the UK



https://www.ecdc.europa.eu/en/publications-data/aedes-albopictus-current-known-distribution-july-2024

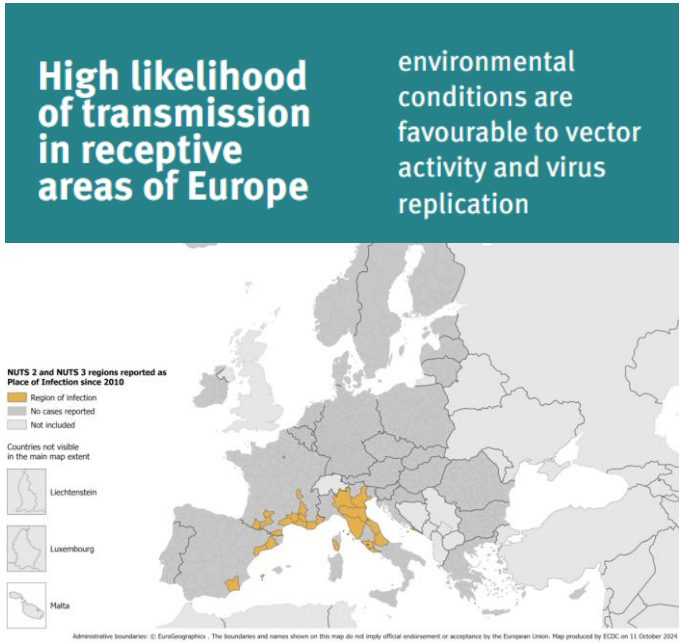
- Eggs and larvae of Aedes albopictus found in traps in 2016 and 2024 in southern England at international truck stops
- Systemic mosquitoe surveillance in place
- Countermeasures were taken

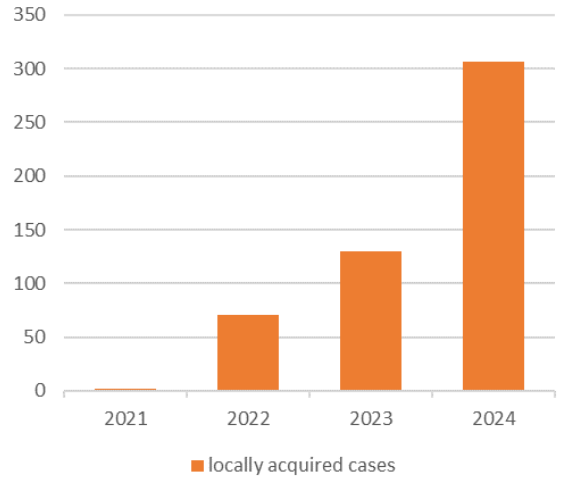
Dengue in Germany 2015-2024



Dengue in Europe

ECDC:





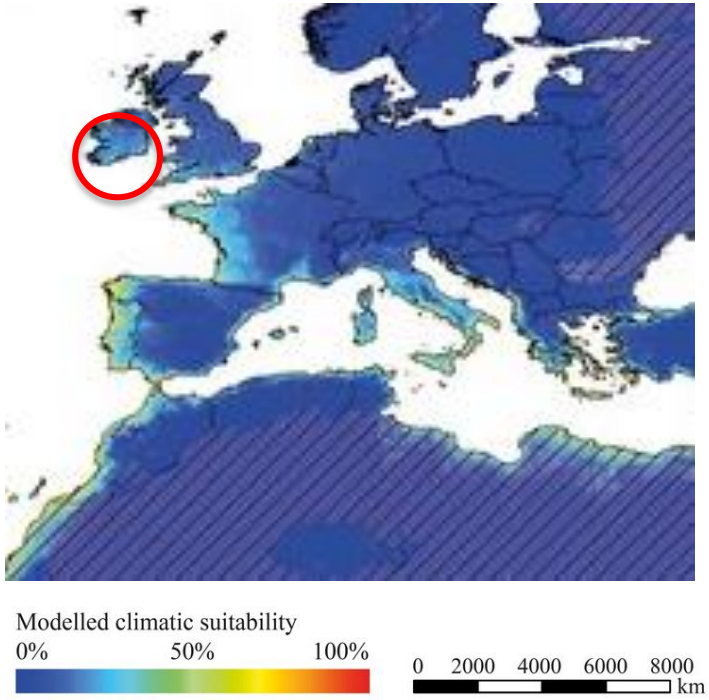
Chagas-disease

Triatoma infestans
Source: Wikipedia

- Pathogen: Trypanosoma cruzi
- Endemic regions currently Latin America and southern USA
- Main vector: Triatoma spp. (kissing bug)
- Many vertebrates are hosts
- Initially swelling, fever, unspecific symptoms, then asymptomatic phase, late stages cardiomyopathy, bowel disorders, neurological symptoms

Transmission via SoHO documented with adverse outcome

Risk for vector endemicity (Triatoma rubrifasciata)



Favourable conditions in coastal regions of Italy Portugal, Spain, France, Greece, Albania, Croatia and Southern England and Ireland

Likelyhood of import?

Fanny E Eberhard, Sarah Cunze, Judith Kochmann, Sven Klimpel
Modelling the climatic suitability of
Chagas disease vectors on a global scale.
eLife 2020;9:e52072. DOI: https://doi.org/10.7554/eLife.52072

Potential carriers of *T. cruzi*

In Germany, roughly **170.000** residents have either migrated from potential endemic regions or are offsprings from female migrants (2nd generation).

Additionally, **>1.3 million** flight passengers per year from Germany to endemic regions

Source: © Statistisches Bundesamt (Destatis), 2023

Trypanosoma cruzi Trypomastigot in blood, Source: CDC

Characteristics of SoHO-relevant pathogens

	Asymptomatic carriers	Local cases in Germany	Vector endemic	Infected animal hosts	Vacci nation
WNV	+	+	+	+	-
Dengue	+	-	(+)	n.a.	(+)
Chagas	+	-	-	-	-

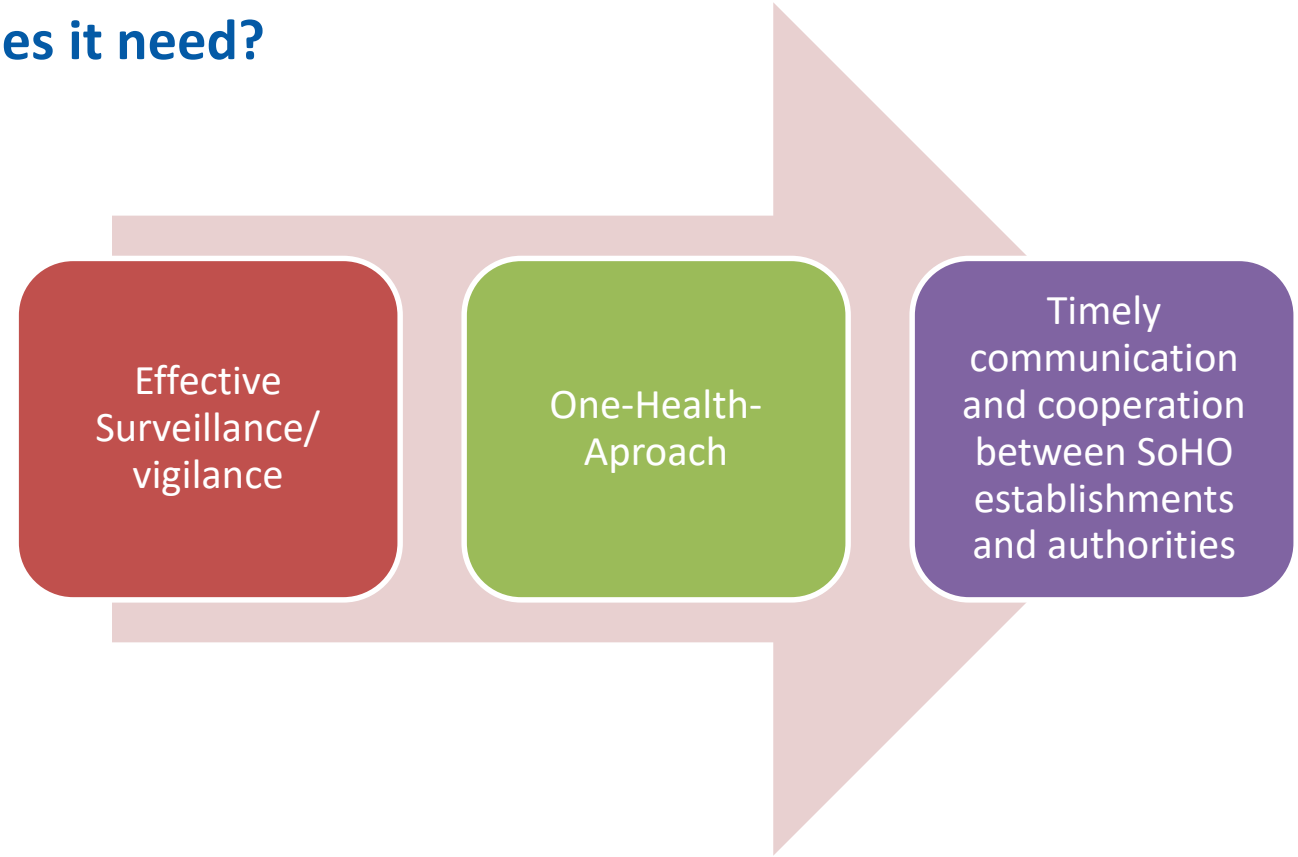
How to maintain blood (and SoHO) safety

Common house mosquito (Culex pipiens) feeding in the S3-Insektarium at the BNITM
Source: BNITM

- Abundant experience with relevant pathogens
- Testing strategies well established
- New screening tests (NAT) can be developed quickly
- Donor selection criteria can be modified

- Pathogen inactivation

What does it need?



Conclusions

- The risk for relevant emerging pathogens is increasing esepcially due to climate change/global warming and worlwide travelling
- The impact depends on various additional factors
- Donor selection, testing for pathogens and – where applicable – pathogen inactivation are important to avoid transmissions
- **Intensified surveillance of emerging pathogens in animals and humans (one health approach) and close cooperation between authorities and SoHO entities are essential to ensure product safety**

Thanks to

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Raskit Lachmann

Thank you for your attention!

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