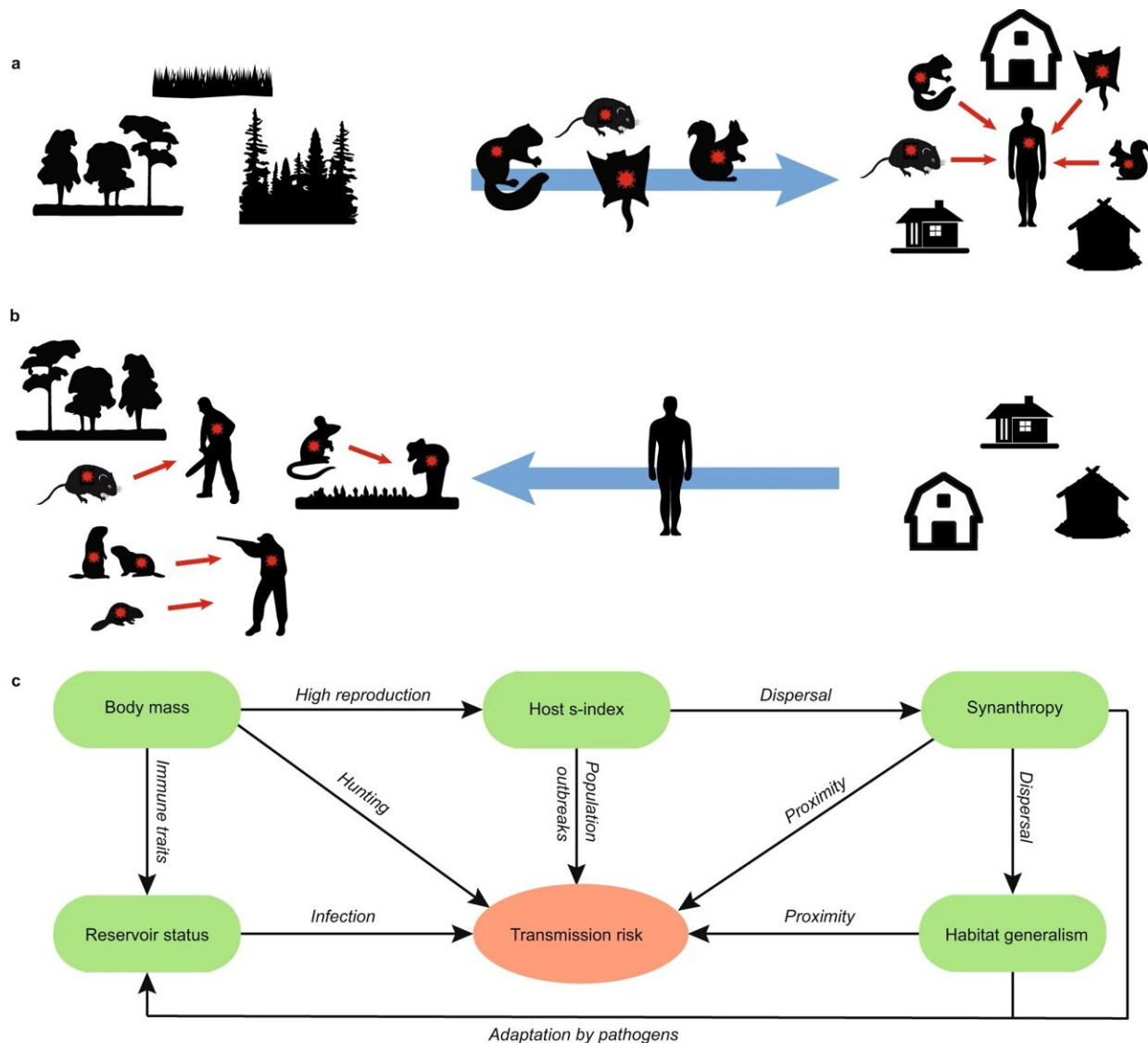


Why humans get infected with rodent-borne diseases

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Pathways increasing transmission risk from rodent-borne pathogens. **a**, **b** Contact between rodents and humans increases transmission risk; **a** either with rodents

moving into human dwellings and environments or with **b**, humans moving into rodent habitats or using rodents as a natural resource. **c** Factors (green boxes) and associated key traits of mechanisms (arrows) explaining increased transmission risk from rodent-borne pathogens. Description of mechanisms: Body mass as a key life history trait can dichotomously increase transmission risk. While rodents with high body mass are frequently hunted for fur or meat, many rodents with low body mass have less developed immune defense strategies and exhibit large population fluctuations (high s-index) resulting in population outbreaks. Periods of high rodent population density are frequently associated with abundant dispersal into human-dominated environments. As pathogens are frequently associated with synanthropic and habitat generalist rodents, these rodents increase transmission risk via proximity to humans. Being a reservoir poses an apparent transmission risk. In the light of many rodent-borne pathogens still being undetected, factors like synanthropy, habitat generalism, high population fluctuations and/or high body mass are important predictors of transmission risk. Credit: *Nature Communications* (2022). DOI: 10.1038/s41467-022-35273-7

The COVID-19 pandemic has stressed the need to better understand the transmission routes of animal-spread diseases. A study published in *Nature Communications* demonstrates how the risk of pathogen transmission from rodents to humans is driven by the interplay between natural and human-caused factors.

Rodents' "fast life" with [sexual maturity](#) at early age, many litters per year and numerous young per litter offer an explanation as to why rodents are important reservoirs for pathogens. But why do humans get infected by rodent-borne pathogens?

"Most rodents that spread zoonotic pathogens, meaning pathogens spreading between animals and humans, show large population fluctuations, move at least occasionally indoors, or are hunted for meat or fur. Our results were consistent among pathogen types (i.e., virus,

bacteria, fungi, and parasites). And also with transmission modes, i.e., intermediate, involvement of vectors or non-close and close contact, with close contact including inhalation of contaminated aerosols," says Frauke Ecke, project leader and Professor at University of Helsinki, Finland and senior lecturer at Swedish University of Agricultural Sciences (SLU).

Global study on 436 rodent species

In the study published in *Nature Communications*, researchers from SLU, University of Helsinki and Cary Institute of Ecosystem Studies, U.S., performed a global quantitative study based on data collected from research papers and databases.

The study includes 436 [rodent species](#) of which 282 are all known reservoirs of zoonotic pathogens. The researchers studied the linkage among the rodents' choice of environment, variation in numbers (e.g., population fluctuations and humans' hunting of rodents), and the status of rodents as reservoirs.

"It is remarkable how consistent the results are among continents, disease systems and rodent species," says Rick Ostfeld, co-leader of the study.

Some areas of the world are at greater risk

In addition, the researchers have identified regions where transmission risk between rodents and humans is high. Large parts of Europe, especially central and northern Europe, a wide stretch extending from eastern Europe to eastern Asia, eastern China, parts of South America, south-east Australia, and eastern regions in North America are at high risk.

"If people encounter a rodent in these regions, there is a high risk that this [rodent](#) carries zoonotic pathogens," says Ecke.

Examples of such pathogen-carrying rodents include the bank vole in Europe, the North American deer mouse, and Azara's Grass Mouse in South America. These species show large population fluctuations and can also move indoors.

"It is especially the large population fluctuations together with the disturbance of the rodents' [natural habitat](#) that can explain why rodents move nearby and into human dwellings. This movement behavior is typical for so-called generalists, which are species that can cope with many different environments. These generalists are the most important reservoirs of pathogens," explains Ecke.

More information: Frauke Ecke et al, Population fluctuations and synanthropy explain transmission risk in rodent-borne zoonoses, *Nature Communications* (2022). [DOI: 10.1038/s41467-022-35273-7](https://doi.org/10.1038/s41467-022-35273-7)

Provided by University of Helsinki

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