Researchers outline the process by which viruses spread from bats to humans

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Zoonosis. A dog with rabies. Credit: CDC

(Phys.org) —A large team of researchers with members from the U.S. and Australia has created a paper that delineates the cross-species spillover dynamic involved with viruses that spread from bats to humans. In that paper, published in *Proceedings of the Royal Society B: Biological*

Sciences, the team concludes that the relatively recent trend of humans contracting more and more diseases that originate in bats is likely due to human activities such as encroachment on land already being used by bats.

In recent years, bats have joined the list of animals (birds, pigs, etc.) that harbor so named zoonoses—infections that move between species. One of those diseases in the news is the Ebola virus, which many scientists believe originated in bats. Sadly, our knowledge of how viruses move from one species to another is still rather limited, the authors note, which means a lot of work needs to be done. Figuring out how it happens might help prevent it from happening in the future. To further that cause, the researchers with this effort have outlined the path by which diseases make their way from bats to humans.

The researchers don't know how bats get a disease in the first place, but suspect its part of a process that has been going on for thousands of years. Bats live closely together and tend to infect others of their kind quite rapidly. But, over time, the bats have developed an immunity of sorts. They get the disease, but it doesn't kill them, or stop them from living their lives—and that's part of the problem. They leave behind urine, feces and saliva, all of which can serve as a carrier to another species—horses, for example, or monkeys. If a horse eats the grass that is growing under a tree habituated by bats, it's very likely to get a disease. This happened with the Hendra virus in Australia. And if that horse makes its way back to the barn, it's likely to infect other horses that live there. And if a human being takes care of that horse, that person is likely to become infected as well.

It's all happening, the researchers claim, because humans are cutting down trees used by bats and using the land for other purposes—to put up houses, for example, some of which have trees in their yards. If they are fruit trees, the bats will take up residence, increasing the likelihood of a

virus being spread to the people who live there. They note that getting rid of bats is not an option—that would be an ecological disaster—instead they suggest that the best way to prevent viruses jumping to people is to stop people from encroaching on the land where bats live.

More information: Ecological dynamics of emerging bat virus spillover, *Proc. R. Soc. B*, 7 January 2015 vol. 282 no. 1798 20142124 Published 12 November 2014. DOI: 10.1098/rspb.2014.2124

Abstract

Viruses that originate in bats may be the most notorious emerging zoonoses that spill over from wildlife into domestic animals and humans. Understanding how these infections filter through ecological systems to cause disease in humans is of profound importance to public health. Transmission of viruses from bats to humans requires a hierarchy of enabling conditions that connect the distribution of reservoir hosts, viral infection within these hosts, and exposure and susceptibility of recipient hosts. For many emerging bat viruses, spillover also requires viral shedding from bats, and survival of the virus in the environment. Focusing on Hendra virus, but also addressing Nipah virus, Ebola virus, Marburg virus and coronaviruses, we delineate this cross-species spillover dynamic from the within-host processes that drive virus excretion to land-use changes that increase interaction among species. We describe how land-use changes may affect co-occurrence and contact between bats and recipient hosts. Two hypotheses may explain temporal and spatial pulses of virus shedding in bat populations: episodic shedding from persistently infected bats or transient epidemics that occur as virus is transmitted among bat populations. Management of livestock also may affect the probability of exposure and disease. Interventions to decrease the probability of virus spillover can be implemented at multiple levels from targeting the reservoir host to managing recipient host exposure and susceptibility.