

The roles of human-to-human transmission and 'super spreaders' in controlling Lassa fever

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One in five cases of Lassa fever – a disease that kills around 5,000 people a year in West Africa – could be due to human-to-human transmission, with a large proportion of these cases caused by 'super-spreaders', according to research published today in the journal *PLOS Neglected Tropical Diseases*.

Lassa fever is an acute viral haemorrhagic illness caused by Lassa virus. First identified in the village of Lassa, Nigeria, in 1969, the disease is

thought to be transmitted to humans from contact with food or household items contaminated with rat urine or faeces. There have also been recorded cases of human-to-human [transmission](#) within hospital settings, but until now the risk – or mode – of transmission has not been clear. Understanding the different modes of transmission and how they are affected by factors such as people's interaction with their environment is crucial for understanding the link between Lassa and changes in the ecosystem, and has important implications for [public health strategies](#).

"Given the many competing health priorities in West Africa – exacerbated by the current Ebola epidemic – it is essential that we know the relative risk of human-to-human transmission of other potentially deadly diseases, such as Lassa fever," says first author Dr Gianni Lo Iacono from the Department of Veterinary Medicine at the University of Cambridge. "That way, [public health officials](#) can decide where to focus their [public health](#) campaigns and how to prevent or respond to potential outbreaks."

The researchers, part of the Dynamic Drivers of Disease in Africa Consortium, used mathematical modelling to analyse data from outbreaks known to be due to human-to-human chains of transmission, and calculated the 'effective reproductive number'. This number represents the number of secondary infections from a typical infected individual – for an outbreak to take hold, this number needs to be greater than one. They compared data from hundreds of Lassa infected patients from Kenema Government Hospital, in Sierra Leone, who could have been infected either by rodents or humans, with the data from human-to-human chains. By considering the effective reproductive numbers, they inferred the proportion of patients infected by humans rather than rodents.

The researchers estimated that around one in five cases (20%) of

infection is caused by human-to-human transmission. However, the study also highlighted the disproportionate number of infections that could be traced back to a small number of people, whom the researchers describe as 'super-spreaders' – rather than passing their infection on to just one other person (if at all), these individuals infected multiple others. It is not clear what makes them a super-spreader – their physiology, the environment in which they live, their social interactions or probably a combination of these factors.

Dr Donald Grant, chief physician at the Lassa ward in Kenema Government Hospital and co-author of the research, said: "Simple messages to the local people could change their perceptions of risk and hopefully make the difference. For example, making people aware that the virus can remain in urine for several weeks during the recovery period, could promote improved hygienic practices.

"What's more, measures to target human-to-human spread of Lassa virus can be bundled in with prevention interventions for diseases with similar transmission routes, such as Ebola and even Hepatitis B."

Professor James Wood, Head of the Department of Veterinary Medicine and senior author on the study, says: "The idea of super-spreaders in infectious diseases is not new. We've known about them since the notorious case of 'Typhoid Mary' in the early twentieth century and they've been documented for other diseases including TB, measles and SARS.

"Although we don't understand what makes someone a 'super-spreader', it highlights the importance of strict hygiene measures in preventing infection. In the case of Lassa fever, we now know that whilst the chance of transmission between humans is much lower than it is from rodents, it is still a very real risk."

Further progress has been hampered by the Ebola outbreak, which has resulted in the death of key collaborators in Kenema Government Hospital, which was used to nurse Ebola patients, in particular Dr Sheik Humarr Khan, who played such a key role in establishing and furthering the Lassa fever research programme.

More information: G. Lo Iacono, A. A. Cunningham, E. Fichet-Calvet, R. F. Garry, D. S. Grant, S. H. Khan, M. Leach, L. M. Moses, J. S. Schieffelin, J. G. Shaffer, C. T. Webb, J. L. N. Wood. "Using modelling to disentangle the relative contributions of zoonotic and anthroponotic transmission: the case of Lassa fever." *PLOS NTD*; January 2015. [www.plosntds.org/article/info:doi:10.1371/journal.pntd.0003398](http://www.plosntds.org/article/info:doi/10.1371/journal.pntd.0003398)

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