Risk of widespread outbreak of Rift Valley fever linked to livestock trade

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The emergent Zika virus (ZIKV), chikungunya virus (CHIKV), and West Nile virus (WNV) outbreaks in the Americas demonstrate the importance of risk assessment and outbreak mitigation for diseases that have been primarily contained within a specific region. Given the potentially severe public health and economic impacts that a sudden emergence of Rift Valley fever virus (RVFV) may have on naïve populations, research efforts involving RVFV have been primarily dedicated to identifying risks associated with potential spread to previously unaffected populations, and to the design of safe and effective vaccines for both livestock and humans.

A recent publication by Lancelot et al. suggests that livestock trade may be an immediate indicator of future epidemics. Livestock, specifically sheep, cattle, and goats, were identified as animal hosts in initial records of RVFV's emergence in the Great Rift Valley of Kenya in 1931 (Daubney & Garnham, 1931). Yet the factors that lead to emergence of RVFV have yet to be identified. Why did this virus emerge in this specific area of Africa, and what caused it to be limited to the African continent until the early 2000s?

The retrospective analysis of environmental conditions and historical livestock trade in relation to Rift Valley Fever (RVF) epidemics in Madagascar performed by Lancelot et al. gives a unique glimpse into the drivers of disease emergence. Madagascar, while geographically isolated from the mainland of Africa, depends on trade from Mozambique and Tanzania. The first RVFV epidemic in Madagascar occurred in the early 1990s, suggesting specific conditions or events facilitated the spread after almost 60 years of endemic cases throughout sub-Saharan Africa.

RVF outbreaks have been linked to climate conditions. Anyamba et al. have reported the influence of environmental factors on mosquito-borne virus epidemics (Anyamba et al. 2014), specifically RVFV (Anyamba et al., 2010), and the potential for using environmental conditions as predictors for future outbreaks (Anyamba et al., 2009).

Heavy rainfall and flooding can affect mosquito populations by increasing preferred breeding environments through flooding and water collection (Anyamba et al., 2014) (Lancelot et al., 2017). Despite significant rainfall in Madagascar in 1994 and 2015, RVFV outbreaks were not detected as a result. Instead, Lancelot et al. give more weight to anthropologic factors, such as livestock trade and trafficking, and working in an abattoir, than fluctuations in environmental conditions, for RVF emergence in Madagascar.

Mapping cattle trade routes into Madagascar and the trade hubs on the island overlapped with hotspots of seropositivity in humans (Lancelot et al. 2017). Humans can become infected by vector exposure or through contact with infected animals, infected fluids, or the consumption of raw milk from infected animals (LaBeaud et al., 2015). Madagascar contains a significant population of farmers, abattoir workers, butchers, and animal handlers, all of whom are at a significantly higher risk of exposure due to the high volume of animals and fluids they encounter due to job detail.

Madagascar is an extremely poor country with limited resources. While the geographically isolated nature of the island provides an important window into how and when RVFV may emerge in new areas, Madagascar may not be a perfect model for the potential emergence into more developed countries. However, the weak link between RVFV outbreaks and environmental patterns in this setting is a nod to the surprising nature of these viruses.

For more information on Rift Valley fever please check our new Best Practice topic.

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