Research into the spread of foot-and-mouth disease (FMD) in east Africa is being used by the Government of Tanzania and local communities to help develop strategies to manage the disease in livestock. The research, led by Professor Sarah Cleaveland¹ and Dr Tiziana Lembo² at the University of Glasgow³, found that outbreaks of FMD in Tanzania are driven primarily by factors related to livestock, rather than through interactions with wildlife.

The research was funded by BBSRC, DFID and the Scottish Government through the Combating Infectious Diseases of Livestock for International Development (CIDLID) initiative⁴.

The results are informing the work of the Government of Tanzania to develop an FMD action plan. Information from the project also enabled officials to place Tanzania on an international framework called the ‘Progressive Control Pathway for FMD control’ (PCP-FMD), which provides a stepwise approach to tackling FMD⁵.

Local communities are also benefitting from the results. Through a series of community workshops, the researchers were able to provide livestock keepers with an overview of FMD in the region and practical advice to help reduce the spread of the disease⁶. Such engagement is also supporting the researchers as they rely on local people for information about FMD outbreaks and for access to animals for sampling, as well as for identifying further research needs.

The results have important implications for conservation in East Africa, suggesting that using fences to separate wildlife and livestock would not be an effective strategy for controlling FMD in the region. In southern Africa, fencing is often used to separate livestock and wildlife to reduce the risk of disease spread, but such fences can fragment habitats and limit animal movement. The resilience and integrity of East African ecosystems, which support a large tourism industry, depends on the ability of the animals to migrate, necessitating co-existence between wildlife and livestock.

The cost of foot-and-mouth disease
FMD is a disease of cloven-hoofed animals such as cattle, sheep and buffalo. The disease occurs globally, and is endemic in some areas such as Africa and southeast Asia⁷. Although rarely fatal in adult animals, the disease causes weight loss and decreased milk production, with serious consequences for livestock keepers whose livelihoods depend on their animals. Consistent with studies elsewhere in Tanzania⁸, livestock keepers in the CIDLID project reported impacts in relation to loss of milk production, milk sales, and body condition, and a reduction in draught animal power (e.g. for ploughing or transport), with implications for food security and household expenditure on medical and school costs.

There is no treatment for infected animals. Vaccines can help prevent infection, but the FMD virus exists as one of seven ‘serotypes’, five of which are known to occur in East
Government and communities in Tanzania benefit from foot-and-mouth disease research

Africa, and vaccines against one serotype will not protect against the others.

According to Cleaveland, “our impression was that [FMD] was ranked highly by livestock keepers. Certainly in East Africa it was in the top five diseases important to them, but they felt that there was little they could do about it, particularly because of concerns about the effectiveness of the vaccines.”

The FMD outbreak in the UK in 2001 cost the economy £8Bn. Globally, researchers at The Pirbright Institute have calculated that the cost of FMD is US$11Bn per year. In Africa, the cost of FMD is around US$2Bn annually, and smallholders can lose anything from 22% to 92% of the value of their animals if herds become infected.

Realistic and feasible approaches
“We became very aware of the problem of FMD as reported to us by livestock keepers, particularly in pastoral areas,” says Cleaveland.

Although FMD is well-understood in developed countries, less was known about other regions, such as East Africa, where the virus is endemic and where outbreaks can have serious consequences for livestock keepers whose livelihoods depend on their animals. The aim of the research project was to conduct a large-scale survey of FMD in six districts of Tanzania to understand the distribution of the virus serotypes, identify the sources of outbreaks and determine the risk factors for infection.

The project found that transmission of FMD from wild buffalo to livestock is not the major factor driving spread of the virus. Instead, livestock factors such as herd management practices and movement of animals were more important in determining disease risk.

The results provide evidence that veterinary game fences, like those used in southern Africa to separate livestock and wildlife populations, would not be appropriate in East Africa. Such fencing can restrict animal movements and fragment wildlife habitats, and could cause substantial damage to ecosystems in East Africa that rely on the annual migration of large animals such as wildebeest and zebra. Instead, livestock vaccination could play an important role in controlling outbreaks.

Community engagement
Through a series of community workshops, designed in collaboration with The Pirbright Institute and supported by MSD Animal Health, the researchers were able to share their findings that wildlife was not the main source of infection for livestock in the region. They also discussed with livestock keepers the actions they could take to reduce the spread of FMD, such as not buying animals showing signs of the disease, and not taking sick animals to communal areas.

“Engaging with stakeholders and target groups allows scientists to understand local perceptions and needs, and research beneficiaries to make use of scientific finding towards better practices. We ran a number of workshops involving local communities where we explained the bigger picture. The participants really appreciated receiving some...”

Chasing foot-and-mouth disease outbreaks and sampling sick animals are essential to understand circulating viruses and obtain field isolates for vaccine selection and production. Image: Tiziana Lembo, University of Glasgow.
feedback and went home with better knowledge as to how to tackle FMD in their herds,” says Lembo, the post-doctoral researcher on the CIDLID project.

The communities are also contributing to monitoring FMD in the region, and have provided the researchers with data for five years so far. Samples from livestock enable the researchers to investigate changes in the virus population and identify which of the seven serotypes is present to inform vaccination strategies.

“The communities have been very supportive,” says Lembo. “They are the ones to call if an outbreak happens in their herd. Having someone who responds to the calls and goes to sample the animals and provides a result, when we can, makes a huge difference to community engagement.”

“I think this has been the most effective project we’ve ever run in terms of community engagement, and it’s really reaping rewards now,” says Cleaveland. “We can see how important that process is, and are trying to integrate it more into our research.”

Supporting policy
Alongside the community workshops, results from the research were shared with Tanzanian officials at a policy workshop in April 2015. Outcomes from that workshop are being incorporated into the FMD action plan being produced by the Ministry of Agriculture, Livestock and Fisheries. One of the main conclusions from the workshop was for the Tanzanian government to focus on vaccination, and to facilitate the import of FMD vaccines into Tanzania.

Outputs from the research also enabled Tanzania to place itself on the international “Progressive Control Pathway for FMD control” (PCP-FMD) developed by the FAO/OIE (Food and Agriculture Organization of the United Nations (FAO) and the World Organisation for Animal Health (OIE)). The PCP-FMD provides a globally-accepted framework for countries, and sets out a stepwise approach to tackling the problem of FMD. Tanzania is currently at stage one of the pathway.

“The BBSRC project has had a great impact for Tanzania, and specifically the results of this important project provided valuable data required for stage one of the PCP-FMD and for developing appropriate strategies for FMD control in Tanzania”, says Dr. Niwael Mtui-Malamsha, responsible for control of transboundary animal diseases at the Ministry of Agriculture, Livestock and Fisheries, Tanzania.

The results also contributed to a workshop of the Livestock Modernisation Initiative, established by the Ministry of Agriculture, Livestock and Fisheries, Tanzania, and endorsed by the President of Tanzania, which concluded that disease-free zones are not an appropriate model for controlling FMD in Tanzania.

“Disease-free zones would have been quite problematic,” Cleaveland explains. “We’ve contributed a substantial amount of data to endorse the view that there are alternative approaches that would be better for the economy, farmers and the environment in Tanzania.”

Discussions with companies engaged in the meat industry in Tanzania led to the same result. “They felt that managing disease risk through the value chain, which might include a vaccination component, should be effective and that disease-free zones would not be needed,” says Cleaveland.

Field diagnostics and vaccines
Vaccination is likely to play a major role in controlling FMD in East Africa, but it currently presents a challenge to implement effectively as currently circulating strains are
Community engagement will continue to play an important role in the research: once a vaccine has been developed, the researchers plan to work with high-risk communities to trial it in the field.

Researchers at The Pirbright Institute, led by Dr. Veronica Fowler, are also working on new technologies to assist with monitoring of disease. Preliminary evaluation of simple diagnostic tests to detect the disease in the field has yielded promising results. The next step is to further develop these technologies so that they could be used by livestock keepers and/or health workers to identify specific serotypes of the virus in the field. This will enable the researchers to better understand the geographic spread of the different serotypes of the disease and, combined with improved genetic sequencing technology, could be used in future to inform vaccination strategies.

Progress has been made in the development of diagnostic technologies that can be applied to field conditions and countries with limited laboratory infrastructure. Image: Tiziana Lembo, University of Glasgow.

REFERENCES

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