

## 02|22: Foot-and-Mouth Disease virus seroprevalence in cattle, sheep and goats from Amudat, Kaabong and Karenga districts; Karamoja region

Karamoja region: A very high risk Foot-and-Mouth [FMD] cluster

### Executive summary

**F**oot-and-Mouth Disease [FMD] is a highly contagious vesicular disease of sheep, goats, cattle, and pigs caused by Foot-and-Mouth Disease Virus [FMDV]. Since its introduction in Uganda in 1953, FMDV has caused several outbreaks with catastrophic effects on livestock keeping communities. For livestock dependant Karamoja communities for example, FMD is ranked as the second most important livestock disease with an estimated crude impact of UGX 41.735 billion [USD 10.9 million]. Economic losses due FMD accrue from reduced fertility, weight gain, and draft power output as well as mortality, control costs, impeded market access and inability to intensively keep very productive but FMD-highly susceptible livestock breeds. FMD control is associated with very high [ $>10$ ] benefit-cost ratios in communities like Karamoja that are heavily dependent on livestock assets and prone to highest impacts due to poor veterinary infrastructure. Unfortunately, these programs are not always sustainable due to lack of human, financial and technical resources to support them. If such programs were to be sustainable, they would have to draw significant investment from government and developing partners. We therefore undertook an FMDV seroprevalence and socio-economic impact assessment to generate datasets that would provide blueprints for use not only to guide risk based FMD control programs but also to work as advocacy tools to attract government and developing partner investment in such programs.

**More than half [58.2 %] and just over a fifth [20.5%] of all screened cattle [n=2,313], sheep and goats' [n=2,116] respectively were seropositive for FMDV.** Factors [increasing age, proximity to international borders, overnight stay in communal kraals, gender (female)] that promote animal comingling were strongly associated with FMDV seroprevalence and should therefore be integrated in designing risk based FMD control programs. Interviews with farmers and animal health workers indicated that **FMD contributed 16% and 9.4% of the total household economic losses in Amudat [USD 2,495] and Kaabong/Karenga districts [USD 6,398] respectively. Additionally, closure of Amudat and Kaabong cattle markets for 6 months due to FMD caused a financial loss of USD 363,169 to livestock traders, meat butchers and local government and USD 2,863,820 to farmers in livestock not sold.** Together, these data indicate that Karamoja region constitutes a very high risk FMDV cluster that warrants risk-based disease control program to prevent FMDV transmission to non-endemic regions of Uganda or even across the international frontiers [Kenya and South Sudan].

### 1.0 Introduction

**F**oot-and-Mouth Disease [FMD] is a highly contagious economically devastating vesicular disease of cloven-hoofed domestic [sheep, goats, cattle, and pigs] and wild animals caused by Foot-and-Mouth Disease Virus [FMDV]. FMDV is very polymorphic; existing as seven distinct serotypes [for simplicity herein after “type”] whose control often require cocktail vaccines made up of all circulating virus types because vaccinating against one type does not protect animals from other virus types. Five [A, O, SAT 1, SAT 2 and SAT3] of the seven known types have been confirmed in Uganda since 1953 when FMDV was first detected in cattle in Uganda. However, the current virus types circulating in Amudat, Kaabong and Karenga cattle and small ruminant populations are yet to be determined. The direct losses due to FMD are as a result reduced fertility, weight gain, and draft power output as well as mortality while indirect losses accrue from costs incurred on control, limited access to livestock markets and inability to use/keep very productive but FMD-highly susceptible livestock breeds and intensification of production. Previously, FMD was reported only to be second in importance to ticks and tick-borne diseases in constraining animal health and production in Karamoja region with an estimated total impact of FMD on Karamoja livelihoods of ~ USD 10.9 million<sup>1</sup>. This high impact was attributed to delays in disease detection and response, sanitary bans on livestock markets and animal movements, inadequate capacity to enforce sanitary bans, and large volumes of distress sales albeit at lower prices.

In developing countries, FMD control programs are not always sustainable due to lack of human, financial and technical resources to support such programs. However, if implemented such programs are associated with high [ $> 10$ ] benefit-cost ratios because such communities are heavily dependent on livestock assets, yet they are prone to extreme impacts due to FMD because of poor veterinary service infrastructure<sup>2</sup>. To be sustainable, FMD control programs in developing countries have to draw significant investment from government and developing partners. As a means of raising advocacy that is requisite to attracting government and developing partner investment in sustainable risk based FMD control programs, there is need to generate area wide FMD burden and socioeconomic impact data to which this study contributed.

<sup>1</sup> FAO,2014

<sup>2</sup> Knight-Jones TJD & Rushton J. Prev Vet Med 2013;112:161–73

## 2.0 Approach and Results

**W**e screened cattle [n=2,313], sheep and goats' [n=2,116] sera for antibodies raised against non-structural proteins of Foot-and-Mouth Disease Virus [FMDV] using highly sensitive and specific competitive Enzyme immunosorbent assay to determine the seroprevalence and distribution of FMDV antibodies in cattle, sheep and goats [sheeps] in the Karamoja region. **More than half [58.2%] [Fig. 1] and just over a fifth [20.5%] of all screened cattle and sheeps respectively were positive for FMDV antibodies;** prevalence estimates higher than those reported in literature for apparently healthy cattle in Karamoja<sup>3</sup> and small ruminant herds elsewhere<sup>4</sup> since this is the first time FMDV seroprevalence for sheep and goats has been reported for Karamoja region. The seroconversion rates of sheep and goats were not significantly different implying that goats and sheep alike are important in the transmission of FMDV. The very high prevalence of FMDV NSP antibodies in apparently healthy cattle and small ruminant herds [Fig. 2] indicates that **Karamoja region constitutes a very high risk FMDV cluster that warrants concerted disease control to prevent disease transmission to non-endemic regions of Uganda or even across the international frontiers [Kenya and South Sudan]**

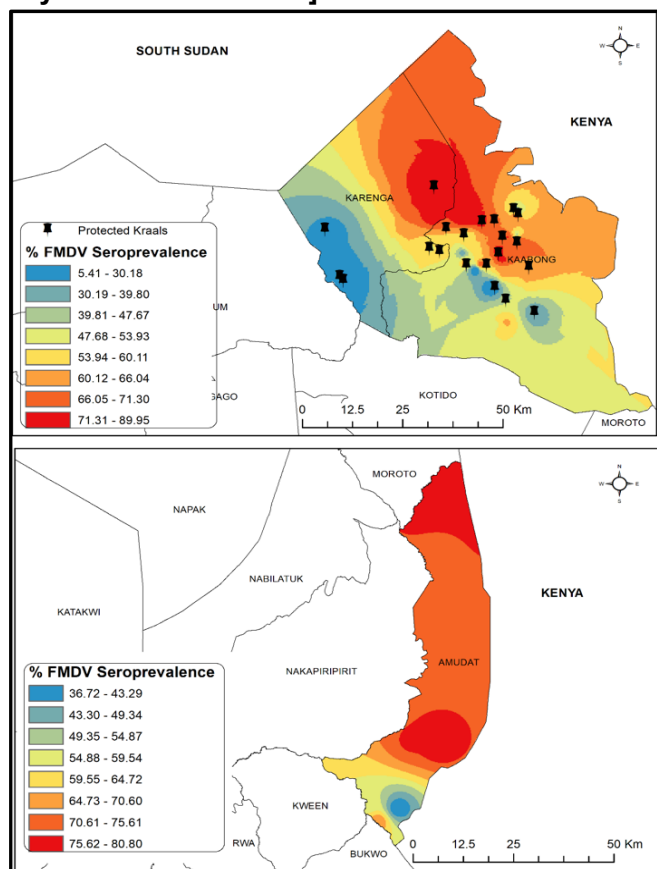


Figure 1. Prevalence of FMDV antibodies in cattle from Amudat, Kaabong and Karenga Districts, Karamoja region. Village level seroprevalence of FMDV ranged from 5.0-81 for every 100 head of cattle

**F**or both cattle and small ruminant populations, the **FMDV seroprevalence was heterogeneous in the study districts with seropositive animals likely to be found along Sudan and Kenya international borders, staying in overnight kraals, older [>1 year] and females [often get in contact with multiple males during mating].** These factors facilitate animal comingling and therefore heighten chances of infection with FMDV.

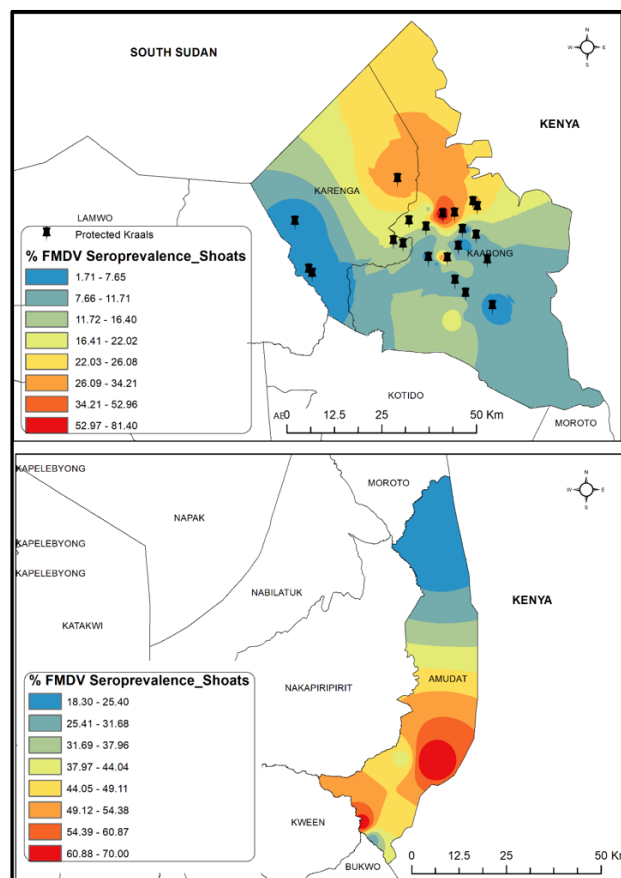


Figure 2: Proportion of sheep and goats that were seropositive for FMDV. Village level seroprevalence of FMDV ranged from 2-70 for every 100 sheep and goats sampled

**I**n addition to cattle and small ruminant screening for FMDV antibodies, we also interviewed household heads of the screened animals and the animal health providers [key informants] who affirmed **that FMD contributed 16% and 9.4% of the total household economic losses in Amudat [USD 2,495] and Kaabong/karenga districts [USD 6,398] respectively.** Additionally, closure of Amudat and Kaabong cattle markets for 6 months due to FMD caused a financial loss of USD 363,169. These losses were majorly to livestock (76.8%) and less for animal product traders (12.2%) and local governments (11%). Forfeiture of animal sales due to FMD outbreaks cost farmers a whopping USD 2,863,820. Animal movement in search for pastures and sharing of communal water points were identified as risk factors for FMDV spread. To help with reducing the impacts of FMD on the already largely

<sup>3</sup> Mwiine FN *et al.* *Transbound Emerg Dis* 2019;66:2011–24

<sup>4</sup> Balinda SN *et al.* *Transbound Emerg Dis* 2009;56:362–71

income [61%] and food [75%] poor<sup>5</sup> Karamojong households, it would be beneficial to design and implement a risk based-FMD control program for Karamoja region. This is particularly important for Karamoja region where 95% of the household livelihoods are derived from livestock whose health and productivity are constrained by a myriad of livestock diseases including FMD. Livestock market infrastructure is key in promoting livestock trade. In Amudat where substantial investment was made in two livestock markets, live animal sales worth USD 326,326 were realised monthly compared to USD 150,978 in Kaabong where there is no livestock market infrastructure, yet Kaabong has 3 times more cattle than Amudat<sup>6</sup>.

### 3.0 Conclusion

**K**aramoja region is a very high risk FMD cluster with the majority of cattle [58.2 %] and a substantial proportion [20.5%] of the small ruminant population recently exposed to the FMDV. Consequently, farmers and animal health providers in the region reported that each household loses 16 % and 9.4% of the total household annual income from livestock enterprise in Amudat [USD 2,495] and Kaabong/Karenga districts [USD 6,398] respectively. Additionally, closure of Amudat and Kaabong cattle markets for 6 months due to FMD caused a financial loss of USD 363,169. Seropositive animals were heterogeneously distributed and most likely to be females, along Sudan and Kenya international, to have overnight stays in communal kraals and older than 1 year. These factors are associated with optimal animal comingling and should therefore form the basis for a risk based FMD control program.

### 4.0 Implications and Recommendations

**T**he majority of Karamojong households are income [61%] and food [74%] poor. Livestock assets from which 95% of Karamojong households derive livelihoods remain the widest gateway for their exit from income and food poverty. Unfortunately, we report here that FMDV is highly prevalent in Amudat, Kaabong and Karenga cattle and small ruminants thereby limiting their health and productivity to the extent that farmers and animal providers ascribed **9-16% of the total annual household economic losses to the livestock enterprise excluding losses due to impeded lucrative market access to FMD**. It is therefore important that follow-up studies are conducted to determine the circulating FMDV serotypes in this region so that properly matched vaccines are procured and used in risk based FMD vaccination program. Such a vaccination program should include sheep, goats, cattle, and pigs. The current practice is to only vaccinate cattle, yet this study

indicates that goats and sheep alike plus the well-known pigs [amplifiers of FMDV] are very important in FMDV transmission. Risk of FMDV seroprevalence was seen to increase with increasing age, female animals [cattle and small ruminants], overnight stay in communal kraals and animals along the international borders. Vaccination programs should be pitched to diminish FMDV transmission risk in these animal categories. For example, a vaccination program that prioritises adult animals [not protected from passive immunity] along international frontiers create a barrier to FMDV transmission to naïve herds. In addition, calves born in such an FMD endemic region are likely to be protected from active infection by maternal antibodies [from similar serotypes they got infected with in the past] which are also known to interfere with antibody formation following vaccination. This would mean that in endemic areas like Karamoja, cattle above 6 months of age are targeted for vaccination and that vaccinating pregnant dams further improves passive antibody transfer efficiency. Establishment of livestock market infrastructure in Kaabong has a high likelihood of increasing the number of livestock traded.

### 5.0 For more Information

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<sup>5</sup> UBOS: UNHS 2019/20

<sup>6</sup> UBOS: National Population & Housing Census 2014