Using networks of livestock mobility to improve control of endemic foot-and-mouth-disease in northern Tanzania

Divine Ekwem
FMD remains endemic in sub-Saharan Africa and the virus circulates freely across countries without any restrictions.

Photo credits: D. Ekwem
Main drivers of infection in cattle are livestock-related as opposed to wildlife-related

- Livestock movements
  - short distance
  - long distance

![Study site map showing Lake Victoria, Kenya, Tanzania, and Serengeti National Park with n=47 and n=93]
Livestock movement data collection

- Community level participatory mapping
- Livestock collaring
- Market data: Livestock movement permits
Community participatory mapping of livestock movements
Main types of local movements

Watering points

Grazing locations

Dipping points

Salting points

Photo credits: D. Ekwem
Livestock movement network: inter-village connectivity
Seasonality of Inter-village connectivity

Dry

Wet
Average distance of villages that are connected across seasons

- Feb
- Apr
- Jun
- Aug
- Oct
- Dec

- Dry season
- Wet season
- Transition
Community detection

Agro-pastoral settings

Pastoral settings

Community size: 8
Modularity: 0.60

Community size: 3
Modularity: 0.30
Tracking outbreaks

CASE HISTORY

SAMPLING

CASE DETECTION

Photo credits: D. Ekwem
Tracking outbreaks: contact tracing + livestock network information
Summary

- Identified key areas and villages important for targeted control options
- Network validation: market + shared resources areas critical for local and sub-local spread
- Livestock movement restrictions are not feasible
- Vaccination remains the ultimate control option for endemic areas

Using centrality measures as proxy to test different FMD control measures for different livestock production systems

Next steps:
- Shipment of clinical samples to reference labs for outbreak confirmation
- Analyses of serological data to infer history of infection
- Analyses of GPS and market data
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