FMD Epidemiology in Africa: patterns of spread and associated risks

Training Workshop on FMD epidemiology, diagnostics and surveillance for strengthening FMD control in Eastern Africa

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Introduction to FMD

- **FMD** is a severe, highly contagious viral disease affecting cloven-hoofed animals, including cattle, sheep, goats, pigs, and wild ungulates.

- **Economic Impact**: FMD causes significant production losses, trade restrictions, and devastating economic consequences for rural communities and livelihoods.

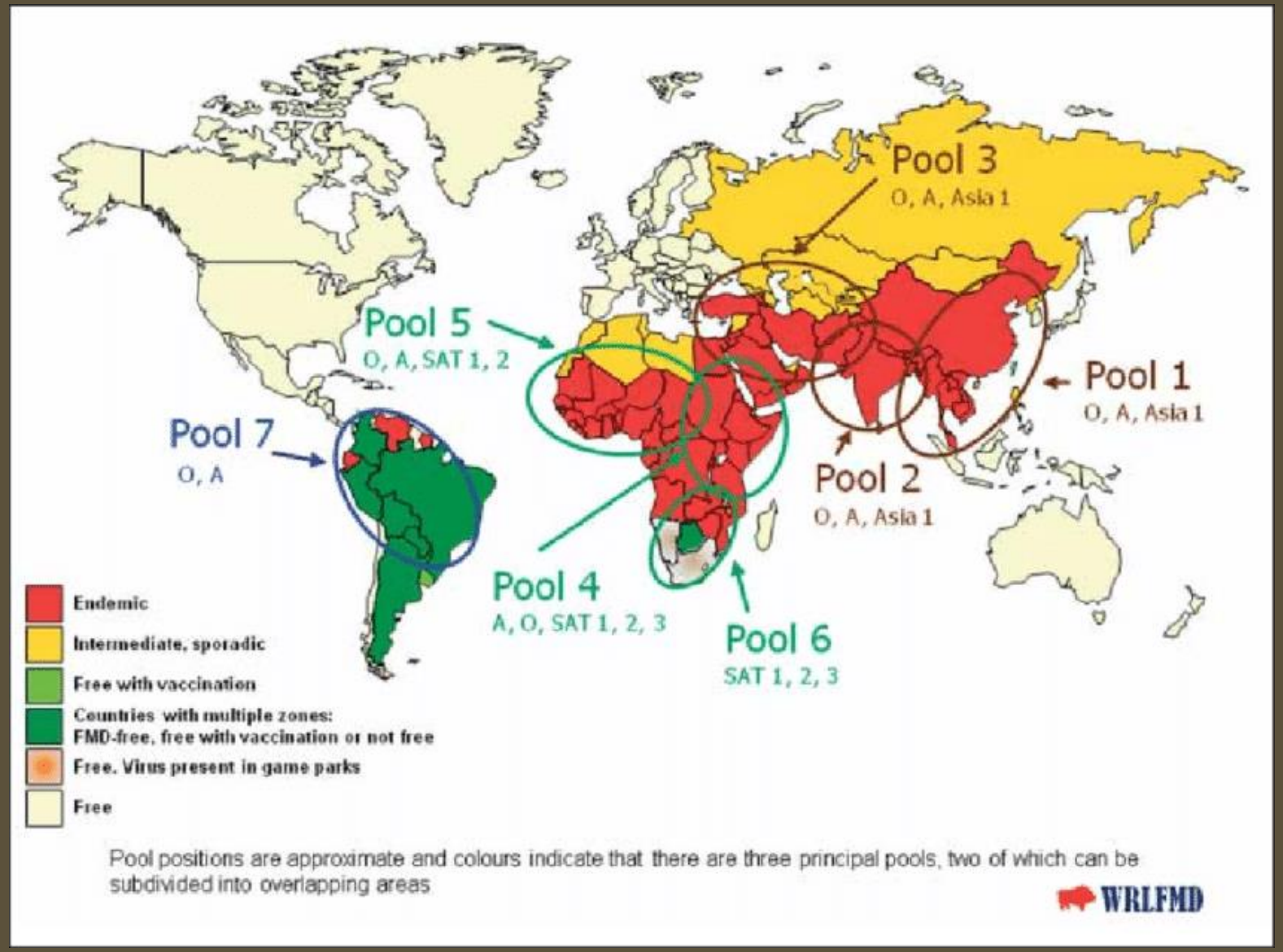
- **FMD in Africa**: The disease is endemic in most of sub-Saharan Africa, where it presents a unique and complex epidemiological picture.

The African Context: Complexity and Diversity

- **Viral diversity**: Six of the seven known FMD virus (FMDV) serotypes (O, A, C, SAT-1, SAT-2, and SAT-3) are present in Africa, which complicates vaccination efforts.

- **Multiple lineages**: Within these serotypes, multiple topotypes (genetically distinct lineages) circulate, making effective vaccine matching a persistent challenge.

- **Regional Variation**: FMD epidemiology differs markedly by region, driven by varying serotype distribution, husbandry practices, and environmental factors.


Pool 3
O, A, Asia 1
Pool 5
O, A, SAT 1, 2
Pool 1
O, A, Asia 1
Pool 7
O, A
Pool 2
O, A, Asia 1
Pool 4
A, O, SAT 1, 2, 3
Pool 6
SAT 1, 2, 3
Endemic
Intermediate, sporadic
Free with vaccination
Countries with multiple zones:
FMD-free, free with vaccination or not free
Free. Virus present in game parks
Free
Pool positions are approximate and colours indicate that there are three principal pools, two of which can be subdivided into overlapping areas
WRLFMD

Key Pattern: 1. The Role of Wildlife Reservoirs

- **African Buffalo**: The African buffalo (*Syncerus caffer*) is a crucial reservoir, particularly for the SAT serotypes.
    - Buffalo can carry the virus persistently for years, posing a constant threat to domestic livestock at the wildlife-livestock interface.
    - Transmission from buffalo to cattle is facilitated by close contact at shared grazing lands and water sources.
- **Other wildlife**: While the buffalo is the most important reservoir, other wild ungulates can also act as intermediate hosts, further complicating disease dynamics. However, transmission in experiments has been difficult to prove
- **Wildlife interface**: High-risk zones for FMD are often located at the interface between wildlife-protected areas, such as national parks, and communal grazing lands.

Key Pattern: 2. Animal Movement and Trade

- **West, Central and East Africa- Pastoralism**: Traditional pastoralist systems involving long-distance, seasonal movements of livestock (transhumance) are a major driver of FMD spread across borders and regions.

- **Informal trade**: Legal and illegal cross-border animal and animal product trade creates pathways for the virus to enter new, uninfected areas.

- **Seasonal fluctuations**: The search for water and pasture during the dry season forces the mixing of animals from different herds and wildlife, increasing the likelihood of transmission.

- **Transboundary spread**: Inadequate and uncoordinated surveillance and control strategies between neighboring countries allow for the rapid, long-distance spread of FMD. Key to coordinate surveillance especially along border areas.

Key Pattern: 3. Livestock Production Systems

- **High-density areas**: Areas with higher cattle and pig density are associated with a greater risk of FMD outbreaks and faster spread.

- **Mixing of herds**: The communal grazing and shared water points common in traditional farming systems facilitate direct contact and transmission between different herds.

- **Varying immunity**: Inconsistent vaccination practices and the use of poorly matched vaccine strains often result in low immunity within livestock populations, even in vaccinated herds.

Associated Risks: A Summary

- **Inadequate biosecurity**: Poor farm-level biosecurity, coupled with the unregulated movement of animals and fomites, allows the virus to spread easily.

- **Climate change**: Changing climate and recurring droughts can alter grazing and watering patterns, increasing contact between herds and wildlife and driving outbreaks. They may also affect disease epidemiology locally so do not rely with gospel truth on what is written in the textbook but observe

- **Strain evolution**: The high mutation rate of the FMDV genome means that new variants (topotypes) can emerge and spread, potentially evading existing vaccine protection. Extremely important to make use of reference laboratory expertise in confirming a diagnosis.

- **Insufficient surveillance**: A lack of coordinated, systematic FMD surveillance, reporting, and molecular characterization limits the ability to track the virus and implement effective control measures.

African Regional complexities

- **Southern Africa**: The region is characterized by SAT serotypes and the constant threat of spillover from the African buffalo population, especially along unfenced borders with protected areas.
- **Horn of Africa**: A "hotbed" for FMD emergence, with porous borders, widespread pastoralism, and multiple circulating serotypes, including O, A, SAT-1, and SAT-2.
- **Recent Outbreak Data**: Progressive spread of serotypes from East/Horn of Africa to the SADC region, such as the spread of serotype O/A- SAT2 from the Horn of Africa to Southern Africa (Namibia, Malawi, Zambia, Mauritius)
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Conclusion

Multifaceted Problem: FMD epidemiology in Africa is a complex interplay of wildlife reservoirs, extensive animal movement, diverse production systems, and viral evolution.

Control challenges: Controlling FMD requires coordinated, regional strategies that account for these unique epidemiological drivers, going beyond fragmented national responses.

Moving forward: Effective strategies must focus on risk-based surveillance, improved vaccine matching, biosecurity, and the careful management of the wildlife-livestock interface.

Recommendations and Outlook

Regional collaboration: Synchronize surveillance and control strategies across countries to better manage transboundary transmission.

Risk-based controls: Implement targeted control measures, such as vaccination and movement restrictions, based on a solid understanding of high-risk areas.

Socio-economic considerations: Control strategies must be adapted to local farming practices and livelihood needs to ensure their feasibility and success.

Research: Continued research into viral dynamics and the wildlife-livestock interface is necessary to refine control strategies for the complex African context.

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