Livestock movement and zoonotic disease outbreaks: applying ecological, network and sociocultural theories for MERS–CoV and camel trade in Ethiopia and Egypt

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Outline

• Camels and zoonotic diseases
• Background on the collaboration
• Framework
• Livestock and camel
  – Movement
  – Economies
• Challenges
• Discussion
Camels and Zoonotic Disease

- Bovine TB (*M. bovis*)
- Rift Valley Fever
- Johne’s Disease [Paratuberculosis]
- Brucellosis
- Trypanosomiasis
- Equine Herpes Virus
- Camelpox
- Others
MERS-CoV

- Middle East Respiratory Syndrome (MERS-CoV)
  - 2012 first isolated
  - Betacoronavirus-SARS
  - 1025 infected humans, 399 died
  - Reservoir? Link to camels?
  - Camel sera—1983
  - Milk
Background on the collaboration

• Multi-disciplinary team
• “One health” training and workshop
• Animal and human ID epidemiology
• Anthropology work– focus pastoralists and camel economies
• Poverty mapping
• Mapping livestock movement and climate
• Networks and disease spread in livestock systems
Articulating a framework

Recognize our disciplinary bias

• Patient-based model – interventions focus on individual over the population

• Population-level pattern of infection within a system of interacting hosts and pathogens - environmental, behavioral, and genetic influences and disease occurrence

• Ecological and evolutionary dynamics of host–pathogen interactions
• **Ecological and Network** theories and a “one health” approach to examine disease emergence within the broader ecosystem:
  
  – **Environment** (flora, climate, pollution)
  
  – **Animals** (distribution and density of animals, interaction between humans, domesticated and wildlife animals)
  
  – **Human behavioral systems** (socio-cultural and economic structures around animal husbandry and hunting, connectivity including market trade systems)
Livestock movement

• 2.3 million livestock cross international borders every year, or over 6000 every day

• In Ethiopia, 9,000 camels are traded with Somaliland ALONE with more crossing international borders and ultimately reaching Djibouti, the Arabian Peninsula
Agricultural regions

Types of Agriculture

1. Shifting cultivation
2. Plantation agriculture
3. Peasant grain, root, and livestock farming
4. Mediterranean agriculture
5. Paddy rice farming
6. Market gardening
7. Commercial grain farming
8. Dairying
9. Nomadic herding
10. Livestock ranching
11. Livestock fattening

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Nonagricultural, usually hunting and gathering

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Camel movement

- Camel movement routes from Western to East Africa, and from East Africa to North Africa and the Arabian Peninsula have been described over 1500 years ago.
Camel economies

• More than 65% of the world’s camels reside in E Afr, majority raised by nomadic Somali tribes
• Camel husbandry has increased exponentially in the last 15 years due to increasing demand for animal protein
  – Ability of camel-based livelihood systems to better withstand drought conditions, environmental variability
• Critical food supplies (milk and meat)
  – 1 million liters of camel milk being exported in the last six months of 2013 from East Africa (underestimate)
  – Transportation
  – Assets for household savings (collateral for loans, wealth)
Mapping

- Anthropological assessments
- Semi-structured interviews with stakeholders
- Desk reviews (narrative literature)
Known camel movement routes from preliminary research

Sampling location

Point of Entry

Point of Exit

Terminal Market

Entry Market
Known camel movement routes from preliminary research
Livestock farming, ranching

- Livestock-raising versus nomadic herding
  - Fixed places of residence
  - Operate as individuals not within a tribal organization
  - Raise livestock for market not for subsistence—not a rule
Livestock farming, ranching

- Livestock-raising versus nomadic herding
  - Fixed places of residence
  - Operate as individuals not within a tribal organization
  - Raise livestock for market not for subsistence—not a rule
- Faced with the advance of farmers, nomadic herders have fallen back to areas climatically too harsh for crop raising
- Moving into (protected) forests
Implications

• Movement and EZIDs
  – MERS in AP
  – Remaining forests
  – Reservoirs
  – Lack of surveillance

• Research gaps
Challenges

• Interdisciplinary work
• Regulations for international work
• Setting up specimen collection, transport and testing
Select references


Thank you!

http://www.health-news.com/medical-research/Camels innocent of MERS until proven guilty

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