Foot-and-Mouth Disease in Vietnam: 
What can we learn?

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NIAA Emerging Diseases Council 2013
Presentation Outline

- Animal health infrastructure in Vietnam
- Project overview
- What can we learn?
Vietnam

- 58 Provinces, 5 Municipalities
  - Multiple Districts within Provinces
Foot and Mouth Disease

- FMDV is endemic in Vietnam
  - Targeted vaccination
- Role of the “carrier” is unknown
  - Persistent infection > 28 days
The Project:
Molecular Epidemiology, Surveillance and Predictive Tools for FMD Control in Vietnam

Drs. Luis Rodriguez, Jonathan Arzt – USDA ARS PIADC
Dr. Ho Hu Dung - MARD DAH
Dr. Nguyen Tung – MARD NCVD
Dr. Ngo Thanh Long – RAHO 6
Dr. Chris Morrissy - CSIRO
Dr. Andres Perez – UC Davis
Project Objectives

1. Characterize the molecular epidemiology of circulating FMDV strains in Vietnam
2. Investigate the role of persistently infected ruminants (buffalo in particular) in FMDV ecology in Vietnam
3. Establish/explore standard operating procedures to quantitate the risk associated with movement of animals out of a currently quarantined region where an FMD outbreak has occurred
Project Objectives

2. Investigate the role of persistently infected ruminants (buffalo in particular) in FMDV ecology in Vietnam
   2.1 Identification of FMD convalescent cattle and buffalo by targeted surveillance
   2.2 Documenting persistent infection in Asian buffalo
   2.3 Investigation of transmission of FMDV from persistent carrier animals to naïve animals
Methods: Objective 2

- Two Provinces identified with history of FMD outbreaks in cattle, buffalo
  - SonLa (north)
    - Jan 2011
  - LongAn (south)
    - Feb. 2011
Methods: Objective 2

- Development of serum and probang sampling protocols
- Training of paraveterinarians and veterinarians for probang sampling (Arzt, Feb. 2012)
- Identification of FMDV carriers through serology (3ABC ELISA testing) and probang samplings (PCR, virus isolation) (Huston, May – July 2012)
### Results

<table>
<thead>
<tr>
<th>Province</th>
<th># Tested</th>
<th># Positive</th>
<th>Prevalence (%)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Long An Province</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buffalo</td>
<td>4</td>
<td>4</td>
<td>100.00</td>
<td>39.8-100</td>
</tr>
<tr>
<td>Dairy cattle</td>
<td>452</td>
<td>85</td>
<td>18.81</td>
<td>15.3-22.7</td>
</tr>
<tr>
<td>Local beef</td>
<td>48</td>
<td>21</td>
<td>43.75</td>
<td>29.5-58.8</td>
</tr>
<tr>
<td><strong>SonLa Province</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buffalo</td>
<td>157</td>
<td>43</td>
<td>27.39</td>
<td>20.6-35.1</td>
</tr>
<tr>
<td>Local beef</td>
<td>336</td>
<td>26</td>
<td>7.74</td>
<td>5.1-11.1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>997</td>
<td>179</td>
<td>17.95</td>
<td>15.6-20.5</td>
</tr>
</tbody>
</table>
Table 2: Results from 1\textsuperscript{st} Probang sampling

<table>
<thead>
<tr>
<th></th>
<th># Tested</th>
<th># Positive</th>
<th>Prevalence (%)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Long An Province</strong></td>
<td>104</td>
<td>8</td>
<td>7.69</td>
<td>3.4-14.6</td>
</tr>
<tr>
<td>Buffalo</td>
<td>4</td>
<td>0</td>
<td>0.00</td>
<td>0.0-60.2</td>
</tr>
<tr>
<td>Dairy cattle</td>
<td>83</td>
<td>2</td>
<td>2.41</td>
<td>0.3-8.4</td>
</tr>
<tr>
<td>Local beef</td>
<td>17</td>
<td>6</td>
<td>35.29</td>
<td>14.2-61.7</td>
</tr>
<tr>
<td><strong>SonLa Province</strong></td>
<td>125 *</td>
<td>12</td>
<td>9.60</td>
<td>5.1-16.2</td>
</tr>
<tr>
<td>Buffalo</td>
<td>49</td>
<td>4</td>
<td>8.16</td>
<td>2.3-19.6</td>
</tr>
<tr>
<td>Local beef</td>
<td>76</td>
<td>8</td>
<td>10.53</td>
<td>4.7-19.7</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>229</td>
<td>20</td>
<td>8.73</td>
<td>5.4-13.2</td>
</tr>
</tbody>
</table>

*not all of these animals were serology tested*
Methods: Objective 2

- Establishment of test transmission cells (TTC) to demonstrate persistence and transmission of FMDV
  - 2 positive animals (donors) to be housed with 2 negative animals (sentinels)
  - Longitudinal monitoring
    - 12 months
  - Ring vaccination
Results

- 8 test transmission cells (Sept. 2012 – Feb. 2013)
  - 2 donors, 2 sentinels (2 farms)
  - 1 donor, 2 sentinels (6 farms)
  - 6 samplings
  - No evidence of horizontal FMDV transfer to sentinels
  - Possible vertical FMDV transfer to calves (2/3)
Further work

- Necropsy study in buffalo
  - Dr. Jonathan Arzt, PIADC (Nov. 2012)
- Longitudinal monitoring of TTC
  - Gather final information from farms
  - Possible necropsy of donor animals
  - Dr. Carla Huston (June 2013)
- Analysis of data
  - Phylogenetic analysis
  - Descriptive statistics and comparisons
  - Test comparison
  - PIADC (ongoing)
What can we learn?

1. Good communication will make or break a project.
2. Flexibility and adaptability are necessary skills.
3. Biosecurity is relative.
4. Biotechnology is possible.
5. “Our” priorities may not be “their” priorities.
6. Integrated research is essential.
7. Collaborative research is essential.
8. Local customs and knowledge should be respected.
10. Opportunities can outweigh challenges.
What can we learn?

1. Good communication will make or break a project.
What can we learn?

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<table>
<thead>
<tr>
<th>Samples code</th>
<th>Animal identification (name of animal)</th>
<th>ELISA results on serums</th>
<th>RT-PCR results on probang samples</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Ct value of Positive Control</td>
<td>US positive control 10^6</td>
</tr>
<tr>
<td>B134</td>
<td>Horned (curved horns)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B135</td>
<td>Horned (straight horns)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B136</td>
<td>Calf, white with black patches</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B137</td>
<td>Black cow</td>
<td>dairy cattle</td>
<td>4 M</td>
</tr>
<tr>
<td>B138</td>
<td>Yellow cow, horned</td>
<td>local beef</td>
<td>3 Y</td>
</tr>
<tr>
<td>B139</td>
<td>Yellow cow, dehorned</td>
<td>local beef</td>
<td>3 Y</td>
</tr>
</tbody>
</table>
What can we learn?

2. Flexibility and adaptability are necessary skills.
What can we learn?

3. Biosecurity is relative.
What can we learn?

4. Biotechnology is possible.
What can we learn?

5. “Our” priorities may not be “their” priorities.
   - 2012: H5N1, PRRS, IPN, etc.
What can we learn?

5. “Our” priorities may not be “their” priorities.
   - Food safety and public health
What can we learn?

5. “Our” priorities may not be “their” priorities.
   - 2013: H5N1, H7N9, honeybee diseases
What can we learn?

6. Local knowledge, customs, and culture should be respected.
What can we learn?

7. Development and stewardship go a long way.
What can we learn?

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What can we learn?

8. Integrated research is essential.
   - Experimental studies (in general)
     - Prospective, direct establishment of risk
     - Extrapolation to on-farm applications is limited
   - Observational studies (in general)
     - Retrospective, no direct establishment of risk
     - Subject to multiple biases (selection, recall)
     - Most representative of “real-world” situations
What can we learn?

9. Collaborative research is essential.
   - International collaboration
   - Interagency collaboration
   - Collaboration with NCVD, DAH, RAHO’s
   - Collaboration with District Veterinary Services, paraveterinarians and farmers
- Education and outreach
- Scientific exchange
What can we learn?

10. Opportunities can outweigh challenges.

- **Challenges**
  - Priorities
  - Communication
  - Bureaucracy
  - Data management
  - Biosecurity
  - Protocols and resources

- **Opportunities**
  - Collaborations
  - Education
  - Training
  - Scientific exchange

- **Importance**
  - “Food Security”
  - Development
  - Trade implications
  - Protection of US agriculture
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THANK YOU
XIN CẢM ƠN
Project participants:

USDA – Agricultural Research Service
USDA - Foreign Agricultural Services
Mississippi State Univ College of Veterinary Medicine
Ministry of Agriculture and Rural Development
National Center for Veterinary Diagnosis
Department of Animal Health
Regional Animal Health Office – 6
Sub-Departments of Animal Health
District Veterinary Services
Communal Paraveterinarians
Participating Farmers