Equine Regulatory Diseases and Lessons Learned from Recent Outbreaks

Angela M. Pelzel-McCluskey, DVM
Equine Epidemiologist
USDA, APHIS, Veterinary Services
What Are Regulatory Diseases?

• Diseases reportable by law to state or federal animal health authorities

• Include foreign animal diseases and infectious diseases that are internationally reportable to the World Organization for Animal Health (OIE)

• Other contagious or infectious diseases that have an existing control or eradication program

• Diseases that threaten the national herd either by their clinical features or their impact on international trade
OIE Reportable Diseases – Equine
(Internationally and Federally Reportable)

Equine Only

- African Horse Sickness
- Contagious Equine Metritis
- Dourine
- Glanders
- Equine Infectious Anemia
- Equine Influenza
- Equine Piroplasmosis
- Equine Rhinopneumonitis (EHV-1, EHV-4)
- Equine Viral Arteritis
- Western & Venezuelan Equine Encephalomyelitis

Multi-Species

- Anthrax
- Brucellosis
- Eastern Equine Encephalomyelitis
- Leptospirosis
- Screwworm
- Paratuberculosis
- Rabies
- Surra
- Vesicular Stomatitis
- West Nile

Diseases in Blue: have occurred recently in the U.S.
Regulatory Diseases Frequently Encountered in the U.S.
(Important, but not necessarily High-Impact)

- Equine Infectious Anemia (EIA)
- Equine Viral Arteritis (EVA)
- Eastern Equine Encephalitis (EEE)
- West Nile Virus (WNV)
Equine Infectious Anemia (EIA)

• Viral, blood-borne disease of equids
• Clinical signs include fever, weight loss, yellowing of mucus membranes, anemia, swelling of limbs, can cause death
• If horse survives the acute clinical signs, then it becomes a life-long carrier of the virus and is a source of exposure for other horses
• No vaccine or treatment exists
Equine Infectious Anemia

Transmission

• Blood sucking flies
  • Tabanid (horse & deer fly)
  • Stomoxys (stable fly)

• Mare-to-foal transmission does occur

• Transmission in semen may be possible

• Iatrogenic (human caused)
  • Needles & syringes
  • Dental instruments
  • Surgical instruments
EIA Regulatory Authorities

– Federal regulations control only the quarantine and movement of reactors (confirmed EIA positive animals) between states and approval of labs.
– Each state has its own regulations and movement requirements.
Equine Infectious Anemia

Figure 1. Number of EIAV Tests Performed in the United States, 1972-2005

*Data not available for 1981 and 1982
Equine Infectious Anemia

Figure 2. Percentage of Samples that Tested Positive for EIAV in the United States, 1972-2005

Decrease in prevalence: 4% in 1972 to less than 0.01 % in 2005.

*Data not available for 1981 and 1982
Figure 2. Reported numbers of EIA tests and positive cases in the United States, 2000-2014
Figure 1. Reported numbers of horses and premises testing positive for EIA, 2014

2014: 63 cases on 36 premises
Current issues with EIA

• Limited federal regulatory authority has led to inconsistency across states
• High risk populations
  • Untested herds
  • Horses moving illegally from Mexico
  • Iatrogenic spread in QH racehorses
• Over-testing in the same known negative populations
• Need industry input on next steps
Equine Viral Arteritis (EVA)

- Viral disease of equids
- Causes abortion, respiratory signs, fever, depression, swelling of the limbs, decreased fertility, can cause death
- Airborne/respiratory spread (i.e. close contact), venereal transmission (shed in semen of infected stallions)
- Chronic carrier state and intermittent shedding possible
- EVA vaccine works for prevention of spread and is used extensively in TB stallions (subsequent to large outbreak in KY TBs 1984)
Equine Viral Arteritis (EVA)

- Last large outbreak – New Mexico 2006
- QH breeding farm where all 4 stallions standing at stud and many mares became infected
- 30 abortions recorded (approx. half of the pregnant mares on the farm)
- Virus disseminated to other farms in 18 states by
  - Cooled, shipped semen (48 mares)
  - Mare transport (20 mares and foals)
- Outbreak finally controlled by quarantine and close surveillance
- Exposure of large number of QH stallions, some of which resulted in carrier state and intermittent shedders
Current issues with EVA

• Limited surveillance
  • Some export testing
  • Mostly passive surveillance in response to acute clinical signs
• Outbreaks difficult to control (respiratory spread; cooled, shipped semen)
• Vaccine: requires isolation post-vaccination, difficult to identify vaccinated versus exposed when a vaccination certificate is lost
• Lack of awareness outside of the TB industry
Eastern Equine Encephalitis and West Nile Virus

• Arboviruses spread primarily by mosquitos
• Produce severe neurologic disease in horses; often fatal
• Both diseases transmissible from mosquitos to humans, but not directly from the horse to humans (horses are dead-end hosts)
• Vaccination highly protective for horses
Historic Equine Case Counts

- WNV
- EEE
2014 Eastern Equine Encephalitis (136 cases total)
2014 West Nile Virus Cases (141 cases total)
2015 WNV/EEE cases reported
(data not yet complete)

- **West Nile Virus**
  - 2015: 218 equine cases (31 states)

- **Eastern Equine Encephalitis**
  - 2015: 68 cases (12 states)
Current issues with EEE and WNV

• Vaccination is highly protective, but regular booster vaccination is necessary
• Cases are in unvaccinated or under-vaccinated equids
• Trends toward increase in cases during economic downturns – reduced spending on vaccinations
• Cases likely under-reported (case definition requires diagnostic testing - $$)
Lessons Learned: High-Impact Equine Disease Outbreaks
What is “High-Impact” or “High-Consequence”? A disease with one or more of the following:

- High morbidity or high mortality
- Potential for human health implications
- Foreign animal disease or domestic disease with new increased/unexpected virulence
- Limited intervention options
- Severe or debilitating trade ramifications
- Outbreak that impacts a large number of equids/owners/premises
- Any disease which elicits a palpable level of concern or panic in the equine industry
Recent examples in the U.S.

- Equine Piroplasmosis
  - 2009-2010 Texas Ranch Outbreak
  - Subsequent findings in previous imports and QH racehorses w/ ties to unsanctioned racing
- Vesicular Stomatitis
- Contagious Equine Metritis (2008-2010)
- Equine Herpesvirus Myeloencephalopathy (2011 multi-state outbreak)
Equine Piroplasmosis

• Life-long infection of equids by hemoparasites
  – *Babesia caballi*
  – *Theileria (Babesia) equi*

• Spread by certain species of ticks or exposure to infected blood/blood products

• Mare-to-foal transmission possible, but not efficient

• Clinical signs can include fever, lethargy, inappetence, anemia, icterus, colic, weight loss, exercise intolerance, sudden death; or no signs at all

• Endemic in tropical/subtropical areas of Mexico, Central/South America, Africa, Asia, Middle East, Europe, Caribbean
U.S. Import Requirements

• All horses except those from Canada and Iceland are required to be tested for equine piroplasmosis at the U.S. import center

• Previously used CF test for piroplasmosis until August 2005 – chronic phase of disease can yield false negative on CF

• Now using cELISA test to avoid missing the chronic infections and CFT to catch early infection
History in the U.S.

- Considered a foreign animal disease (FAD)
- Found in portions of FL in the 1960’s, but eradicated in the 1980’s
- Several competent tick vectors present in the U.S.
- Recent outbreaks:
  - **Florida 2008**: 20 horses associated with unsanctioned racing
  - **Missouri 2009**: 8 horses associated with unsanctioned racing
  - **Texas 2009**: 413 horses associated with a ranch in Texas
  - **2010-present**: iatrogenic transmission in QH racehorses and previous imports
Equine Piroplasmosis
Texas – Oct 2009

• Index case – QH mare at south Texas veterinary clinic
• Confirmed at NVSL to be acute *T. equi* infection
• Ranch of origin (located in South Texas) tested:
  – 292 positives out of 360 horses
• Working cow horses
• No risky husbandry practices
• **Heavy tick infestation** (transmission primarily by the Cayenne tick, *Amblyomma cajennense*)
Geographic Distribution of *Amblyomma cajennense*
Summary of Texas Ranch Outbreak

- **2,500 horses tested** in the outbreak
- **413 positive** horses identified
- **Infection on the ranch since at least 1990**
- **Tick-borne transmission** on the index ranch and 4 High-Risk premises near index ranch
- **No spread by ticks on any premises outside of south Texas**
- Need specific **high-risk factors** on a given premises to efficiently transmit *T. equi* to other horses by tick-borne transmission:
  - Multiple infected horses
  - Heavy infestation by competent tick vectors
  - Maintenance of competent vectors year round?
  - Long periods of time in high-risk conditions
2010-2013: EP-Positive Horses Unrelated to Texas Ranch Incident

- Movement and surveillance testing:
  - States imposed movement testing restrictions on each other
  - New Mexico initiated EP testing in QH racehorses
  - Positive findings in racing QHs led to more states with EP testing requirements to enter racetracks
  - AQHA – required EP testing for World Shows 2011 (no positives found)
  - More than 292,000 U.S. horses have been tested for EP since Nov. 2009
Table 1. *EP Testing of U.S. Horses and Positive Findings by Year*

<table>
<thead>
<tr>
<th>Year</th>
<th># Horses Tested at NVSL</th>
<th># Horses Tested at NAHLN</th>
<th>Total # Horses Tested</th>
<th># EP-Positive</th>
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<tbody>
<tr>
<td>2009</td>
<td>9,170</td>
<td>0</td>
<td>9,170</td>
<td>9</td>
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<tr>
<td>2010</td>
<td>42,578</td>
<td>34,225</td>
<td>76,803</td>
<td>143</td>
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<tr>
<td>2011</td>
<td>32,683</td>
<td>42,997</td>
<td>75,680</td>
<td>31</td>
</tr>
<tr>
<td>2012</td>
<td>15,659</td>
<td>29,958</td>
<td>45,617</td>
<td>6</td>
</tr>
<tr>
<td>2013</td>
<td>14,386</td>
<td>24,553</td>
<td>38,939</td>
<td>27</td>
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<tr>
<td>2014</td>
<td>14,656</td>
<td>13,125</td>
<td>27,781</td>
<td>31</td>
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<tr>
<td>2015</td>
<td>10,422</td>
<td>7,813</td>
<td>18,235</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>139,554</strong></td>
<td><strong>152,671</strong></td>
<td><strong>292,225</strong></td>
<td><strong>262</strong></td>
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</tbody>
</table>
EP Positive Horses Unrelated to Texas Ranch Outbreak

Horses imported prior to 2005
• 32 positive horses previously imported from other countries

Sanctioned racehorses with ties to unsanctioned racing:
• 213 positive QH racehorses
• 13 positive TB racehorses

• Epidemiology shows no tick-borne transmission in these cases (iatrogenic transmission in racehorses)
Treatment Update

• High-dose imidocarb treatment protocol
  – More than 200 horses treated so far (including 163 from Texas ranch outbreak)
  – High rate of success – only 9 horses have failed to clear the organism post-treatment
  – Some strain types of *T. equi* are more susceptible to the drug than others
  – Treated, cleared, test-negative horses are eligible for quarantine release

• Texas Ranch update:
  – Euthanized more than 130 horses
  – 163 horses treated and proven cleared
  – As of March 2012, no EP-infected horses left on the ranch
Lessons Learned: EP

- EP has been identified in three distinct populations in the U.S. – Texas ranch incident, horses imported prior to 2005, the QH racing industry (mostly with ties to unsanctioned racing)
- Natural tick-borne transmission of EP in the U.S. is likely to be sustained and efficient only in certain geographic areas if the disease is allowed to exist in horses there
- EP transmission via iatrogenic means is causing ongoing transmission in the U.S. QH racing industry
- Surveillance testing and educational outreach in high-risk equine populations is the most effective way to mitigate iatrogenic spread of EP
- Treatment continues to be a promising exit strategy
- Surveillance in QH racehorses is declining and may not be adequate to find positive horses before they move to other sectors of the industry
Vesicular Stomatitis Outbreaks
Vesicular Stomatitis (VS)

- **Viral disease** that mostly affects horses, cattle, and swine
- Sheep, goats, and camelids (llamas, alpacas) are also susceptible
- Disease causes **formation of vesicles** (blisters) usually seen on the tongue, lips, around the mouth or nose, on the udder or sheath, or along the coronary bands above the hooves
- **Vesicles (blisters) later rupture** and contain the virus (VSV)
- Severe international trade implications
- People can occasionally contract the disease from handling infected animals
Transmission of VSV

• Main routes of transmission
  ➢ Vectors – biting flies
    ➢ Black flies
    ➢ Sand flies
    ➢ Culicoides (biting midges)
  ➢ Direct contact with the ruptured blisters (lesions) of affected animals
  ➢ Contact with areas/objects recently contaminated with virus from lesions
    ➢ Shared water troughs
    ➢ Feed buckets
    ➢ Other contaminated surfaces
Photos by: Dr. Fred Bourgeois and Dr. Greg Chavez (APHIS-VS)
Photos by: Dr. Tim Fox (APHIS-VS) and Dr. Susan Culp (Texas Animal Health Commission)
Photos by Dr. Brian Bohl, Dr. Fred Bourgeois (APHIS-VS) and Dr. Holly Hughes-Garza (Texas Animal Health Commission)
Control and Prevention

- **Quarantine** of infected premises
- Isolation of lesioned animals
- Premises-level vector control
  - Fly sprays/repellents
  - Access to shelter during insect feeding hours
  - Manure management
- No specific treatment available for lesioned animals, just supportive care
- Enhanced **interstate movement restrictions** during an outbreak
Likely Origin of US Outbreaks

Epidemic transmission

Introduction

Endemic cycle
## Outbreaks of VS in Recent History

<table>
<thead>
<tr>
<th>Year</th>
<th># States Affected</th>
<th>States</th>
<th># Infected Premises</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>3</td>
<td>CO, NM, TX</td>
<td>294</td>
</tr>
<tr>
<td>2005</td>
<td>9</td>
<td>AZ, CO, ID, MT, NE, NM, TX, UT, WY</td>
<td>445</td>
</tr>
<tr>
<td>2006</td>
<td>1</td>
<td>WY</td>
<td>13</td>
</tr>
<tr>
<td>2009</td>
<td>2</td>
<td>NM, TX</td>
<td>5</td>
</tr>
<tr>
<td>2010</td>
<td>1</td>
<td>AZ</td>
<td>2</td>
</tr>
<tr>
<td>2012</td>
<td>2</td>
<td>CO, NM</td>
<td>36</td>
</tr>
<tr>
<td>2014</td>
<td>4</td>
<td>AZ, CO, NE, TX</td>
<td>435</td>
</tr>
<tr>
<td>2015</td>
<td>8</td>
<td>AZ, CO, NE, NM, SD, TX, UT, WY</td>
<td>820</td>
</tr>
</tbody>
</table>
2015 VSV Outbreak: Affected Counties
Lessons Learned: VSV

• Planning and preparedness for large scale VSV outbreaks (huge resource drain)
• Education and outreach materials needed for horse owners and private practitioners
• Specific planning needed for shows and events
• Responsiveness to calls and quarantine releases are key to owner compliance
• Public need for timely regular updates on situation and affected areas
• Interstate/international movement requirements – highly confusing
Contagious Equine Metritis
• Venereal disease in horses first reported in England and Ireland in 1977.
• Subsequently identified in many other countries
• Previous U.S. outbreaks in 1978-79, 2006
• CEM is a foreign animal disease in the U.S.
• Strict U.S. testing requirements (both prior to entry and post-entry) on horses imported from CEM-affected countries
Disease Overview

• Caused by bacterial pathogen, *Taylorella equigenitalis*
• Clinical signs, Mares: copious vaginal discharge, infertility
• Clinical signs, Stallions: none
• Treatable condition with specific antibiotics and procedures
Disease Transmission

- Highly contagious via live cover breeding
- Transmission by fomites and inadequate biosecurity (shared AV, wash bucket, iatrogenic spread)
- Organism can contaminate collected semen (AI risk)
- Transmission to foals possible in utero or during foaling
U.S. Import Requirements

- Approved CEM quarantine centers in the U.S.
  – private facilities monitored by state/federal oversight

- For permanent entry of stallions/mares over 731 days of age from CEM-affected regions:
  - Set of CEM negative cultures within 30 days prior to importation
  - Post-entry: move to approved CEM-quarantine facility
  - Stallions – pre-breeding culture, test breeding of two mares, series of post-breeding cultures/CF on the mares, treatment of stallion
  - Mares – 3 sets of cultures, treatment of mare
2008-2010 Multistate Outbreak

- KY stallion found CEM positive on routine culture for shipping semen to the E.U.
- Total of 23 infected stallions and 5 infected mares were found upon completion of the investigation
- 1,005 horses exposed – 278 stallions and 727 mares located in 48 states
- Tracing went back to 2001
- Source of the outbreak was a Fjord stallion imported from Denmark in 2000

Significance:
- Source stallion previously imported and completed official CEM quarantine; not identified as infected
- Extensive stallion-to-stallion transmission via contaminated equipment at semen collection facilities/clinics
- Transmission to mares via artificial insemination (despite appropriate antibiotics in the semen extender)
Stallions can become carriers for years, whereas most mares are capable of clearing the infection. A much smaller proportion of mares can become long-term carrier mares.

Current epidemiological priorities:
Exposed Stallions > Exposed Mares/Geldings > Offspring
Relationships of *T. equigenitalis* Positive Stallions – FY 2009 CEM Outbreak

Bold arrows (→) indicate that a stallion was likely positive for *T. equigenitalis* for part or all of each of the breeding seasons, and at each of the breeding locations, connected by those arrows.

Narrow arrows (―) indicate that a stallion was likely not yet positive for *T. equigenitalis* at the time and location specified by those arrows (see also note C).

The following headings for boxes in this chart represent individual locations where stallions were bred, collected, or resident in a given State and breeding season:

- FL-1 (Florida)
- KY-1, KY-2, KY-3 (Kentucky)
- GA-1 (Georgia)
- NH-1 (New Hampshire)
- IA-1 (Iowa)
- OH-1, OH-2, OH-3, OH-4 (Ohio)
- IL-1, IL-2 (Illinois)
- TX-1, TX-2, TX-3 (Texas)
- IN-1, IN-2 (Indiana)

Notes:
- A = first breeding season
- B = no *T. equigenitalis* positive contacts from a previous breeding season identified
- C = narrow arrows for these stallions indicate that, given the information available, the likelihood of exposure to *T. equigenitalis* cannot be adequately assessed for the specified time and location
- D = last breeding season prior to being gelded
- E = imported from a CEM-affected country
Lessons Learned: CEM

• Despite CEM quarantine and rigorous testing for imports, outbreaks have occurred
• Many different breeds and disciplines can be affected
• Sheer volume and frequency of equine movements lead to continued spread without adequate biosecurity
• CEM testing of over 1000 horses in 48 states is painful and expensive for everyone
• FADs require good domestic surveillance to detect
• Education and outreach to the industry needs to be an ongoing effort (biosecurity in breeding practices and need to test active breeding stallions)
Equine Herpesvirus Myeloencephalopathy (EHM) Outbreak Associated with an Equine Event in Ogden, UT 2011
Equine Herpesvirus Myeloencephalopathy (EHM)

- Equine Herpesvirus-1 (EHV-1) “Rhinopneumonitis”
- Respiratory, reproductive and/or neurologic signs
- Spread by airborne/respiratory route (direct contact)
- EHM: Rapid onset of neurologic signs
- EHM can be caused by either the wild-type strain or neuropathogenic strain
- Supportive care; antivirals
- Death often by euthanasia
- EHV-1 vaccine is labeled for prevention of respiratory form of the disease only, not prevention of EHM
Timeline of Events: Ogden 2011

- **April 29-May 8:** NCHA Regional Championship cutting event in Ogden, Utah (over 470 horses attended from 19 states and Canada)
- **May 13:** Two confirmed EHM cases in Colorado associated with the event; others being identified (neuropathogenic strain)
- **May 13-15:** Misinformation being spread via social media outlets; equine events being cancelled
- **May 16:** AHC, AAEP, State Veterinarians request APHIS-VS assistance
- **May 17:** APHIS-VS issues standardized guidance for management of infected and exposed horses
- **May 19:** APHIS-VS posts 1st national situation report
Exposed Horses

- **Primary Exposed** (attended Ogden, UT event)
  - 421 primary exposed horses located in the U.S.
  - Additional 50 horses from Canada exposed (AB, BC)

- **Secondary Exposed**
  - At least 1,685 horses secondary exposures

- **242 exposed premises in 19 states**
# Cumulative Total Confirmed Cases and Fatalities – June 23, 2011

<table>
<thead>
<tr>
<th></th>
<th># EHV-1 Confirmed Cases</th>
<th># EHM Confirmed Cases</th>
<th># Dead or Euthanized Suspect or Confirmed Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Exposed Horses (at Ogden, UT event)</td>
<td>28</td>
<td>26</td>
<td>10</td>
</tr>
<tr>
<td>Secondary Exposed Horses</td>
<td>29</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Total:</td>
<td>57</td>
<td>33</td>
<td>13</td>
</tr>
</tbody>
</table>
Lessons Learned: EHM

• Frequent and widespread movement of horses in the U.S. is a continued risk factor for significant EHM outbreaks.
• Biosecurity at both the individual horse and individual premises level is the most important method of prevention of disease spread.
• Widespread education and outreach within the equine industry is needed to help individual owners, trainers, event organizers, and equine facility managers understand and implement appropriate biosecurity to prevent spread of EHM.
• During an EHM outbreak, there is need for immediate transparency, notifications, clear guidance, and updated public information on the outbreak to inform decision making at all levels.
• Differences between states on reportability and response measures for EHM have been a challenge to adequate response and prevention of spread.
Overarching Themes

• Structure the equine industry (good and bad points)
  – Vast and highly segmented
  – Independent by nature and composed of individuals with varying levels of awareness and knowledge
  – High level compassion for the horse

• Need for planning and preparedness at all levels

• Education and outreach at all levels and via many methods

• Responsibility for all to communicate and share accurate information in a timely manner (and don’t forget social media)

• Need more interaction between the equine industry groups and state/federal animal health officials to manage and respond to equine disease threats
Questions?