

SECD

Root Cause Investigation in US

Presented by:

Aaron Scott DVM, PhD, DACVPM (epidemiology)

Senior Advisor for Epidemiology and Environmental Science

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- American Association of Swine Veterinarians
- Swine veterinary consultants
- Food and Drug Administration
- Colleagues in Canada and EU
- Universities (MN, ISU, UC Davis, SDSU, OSU, KSU)
- NAHLN laboratories
- APHIS-Wildlife Services
- DHS-National Bioforensic Analysis Center
- Swine producers of the USA
- Units and staff of APHIS-VS

PEDV identified in US; spring 2013

- US Stakeholders respond
- Multiple investigations: private veterinarians, industry organizations, laboratories, Universities, State and Federal officials
- Research studies funded and initiated
- Web sites and information distribution
- Voluntarily submitted testing results

2014: much information ...

- But no conclusive answer to source
- USDA issues Federal Order for reporting as well as funding for response activity
- Also initiates “Root Cause” investigation to revisit information accumulated
- Continued highest priority to find pathway

Root Cause investigation plan

1. Integrate information across all sources
2. Interview consultants, experts
3. Evaluate basic epidemiology: host, agent, environment, timelines, epi curves
4. Formulate criteria and scenarios
5. Collaborate FDA, DHS, industry, universities
6. Revisit farms and attending veterinarians
7. Further investigate scenarios

Basic Epidemiology information

- Three (four?) viruses novel to US swine
- Nearly homologous to viruses that plagued China in 2010-2013 outbreak
- Likely more than one outbreak; April to Dec 2013
- Earliest cases ID'ed in commercial farms
- First cases in growing pigs; their sow farms not infected

Basic Epidemiology information

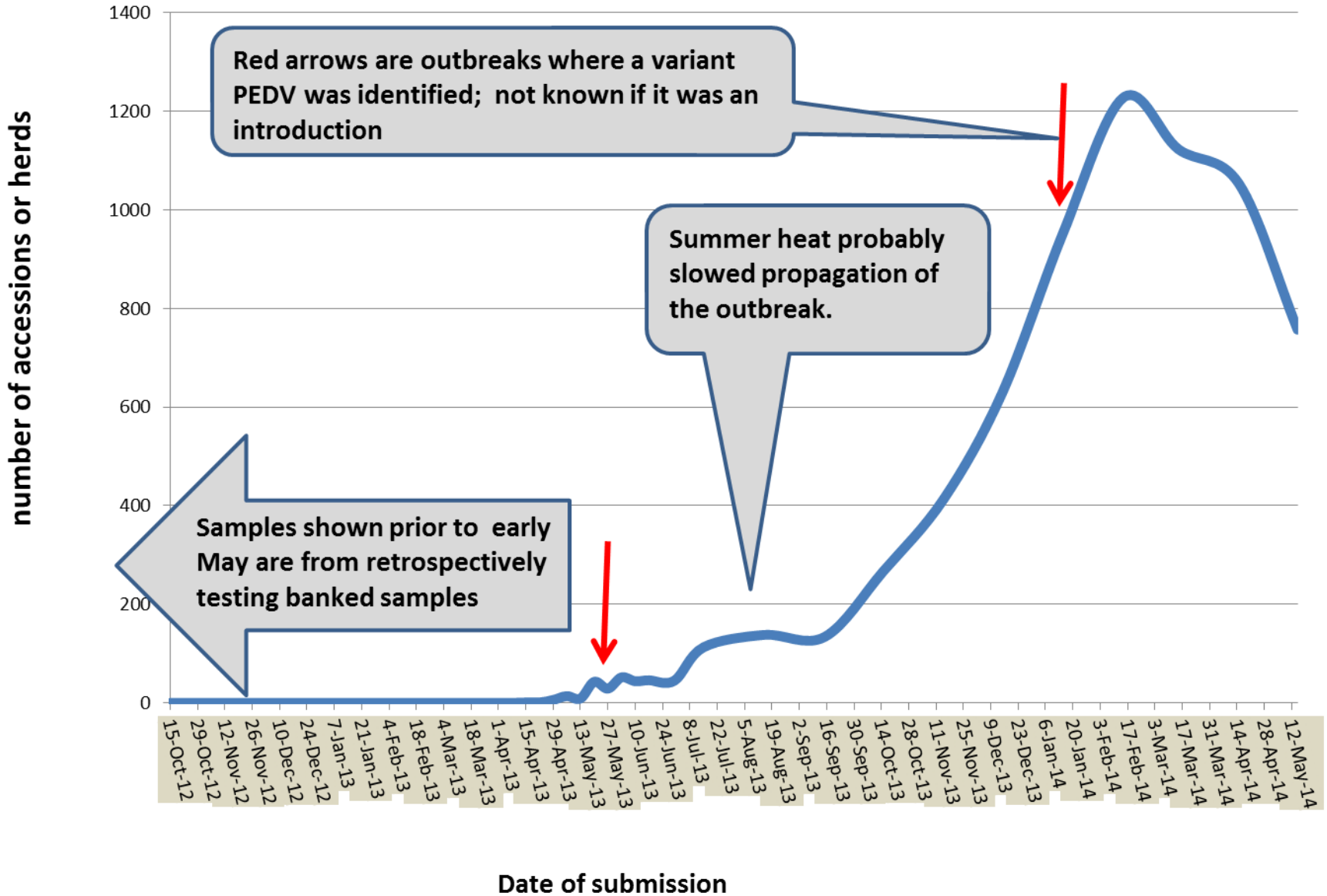
- Infectious 100,000,000x dilution (UMN 2013)
- Survival study: <2 week in dry feed, room temp
- Multiple modes of lateral spread in US
- Farms almost same time in different states, different companies, different feed products
- No direct link between farms

Criteria for source

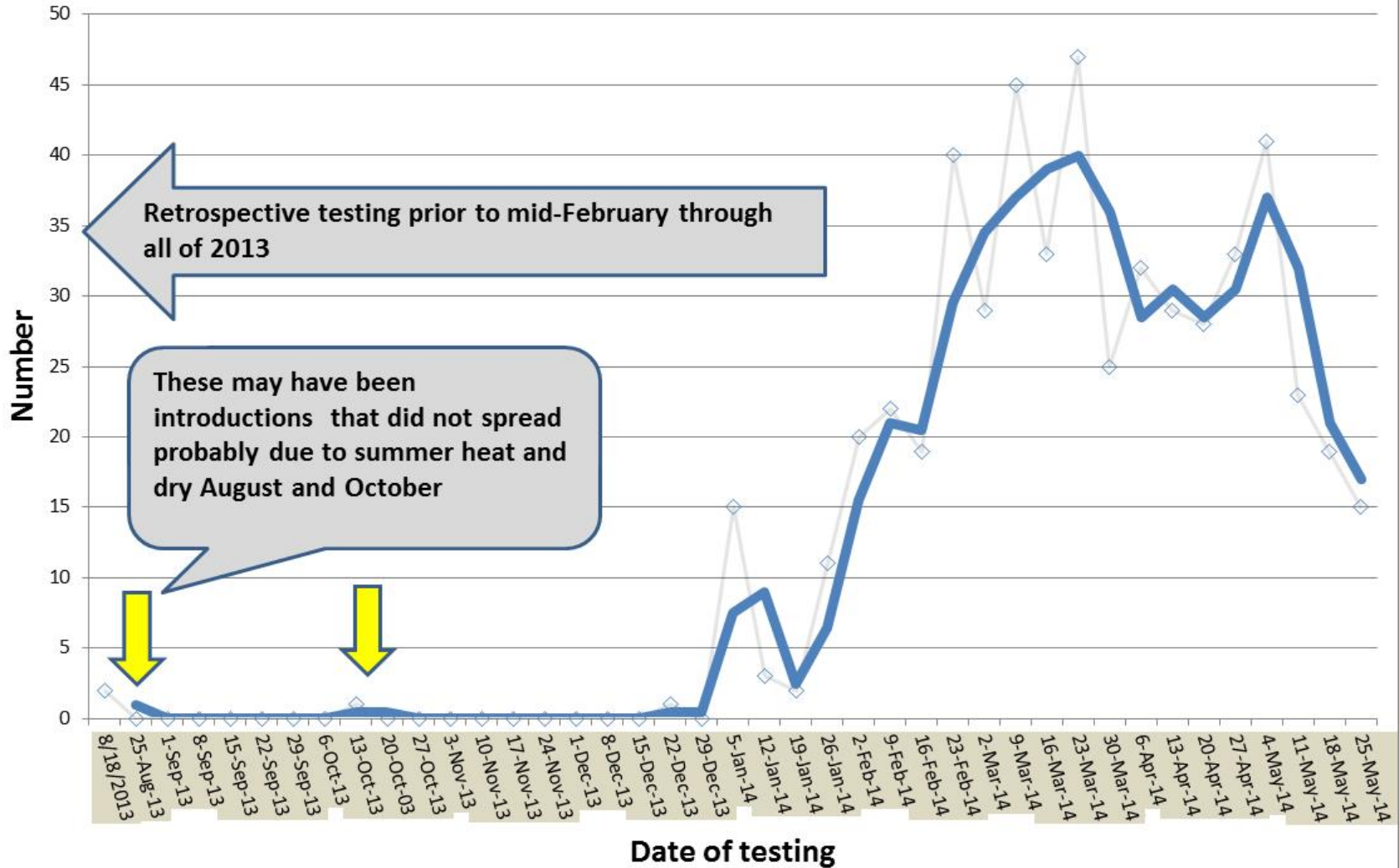
- Must fit basic epidemiology information
- Must survive for 3-6 weeks if on ship or few days for plane travel from an international source
- pH~6.5, low temperature, moisture or matrix to protect from desiccation
- Why US outbreak, but not Canada or EU?
- Why during April-Dec 2013?

Number PEDV pos herds or accessions

Data as of 7/16/14



Number of PDCoV herds or submissions Data as of 7.16.14



“...when you have eliminated the impossible, whatever remains, however improbable, must be the truth...”

Sir Arthur Conan Doyle

Scenarios

- Intentional introduction
 - No evidence to indicate introduction directly to farms
 - No visitors or unusual events were noted
- Circulating in Feral swine
 - Farms large commercial-no evidence of feral exposure
 - Farms same time in different states, companies
 - No knowledge of infection in outdoor domestic
 - Scenario: feces → truck or person → feed mill or farm
 - Scenario: Blood?

Scenarios

- Clothing/shoes while traveling
 - No history of visitors to infected farms or international travel in time frame
 - Not before April 2013

- Human nasal passages (study underway)
 - Should have shown up in previous years
 - No travelers to infected farms in time frame

Scenarios

- Escape from laboratory or diagnostic sample
 - No evidence to suggest association
 - Farms near same time but in different states/companies

- Contaminated biological
 - No evidence to suggest a biological
 - No consistently used product

- Antibiotic filler; e.g., rice hulls
 - Possible contamination in processing
 - Same products used in Canada?
 - Product is very dry (~3-5%)

Scenarios

- Semen or live animals
 - No legal import from possible sources
 - Majority of early cases in growing pigs not sows
- Birds or bats
 - Genetic epi links US viruses to pigs more recently
- Illegal product entry
 - No evidence to suggest
 - Feed products from different feed mills/manufacturers

Scenarios

- Imported organic soybeans or corn
 - Imported product → X-contam in truck/grinder → next product to pigs
 - US imports some of these products
 - No links at this time
- Trucks: feed transport, salvage products
 - Contam product → Product cooked or dries out → truck's next load is complete feed/pellets/grain/whey → pigs

Scenarios

- Vitamin/mineral premixes
 - Same products used in Canada and EU?
 - Products are dry (~5-7%)
 - Gelatin coating??

- Amino acid supplements
 - Common to all rations
 - Lysine price competition in early 2013
 - Most manufactured in microbial culture
 - Same product used in Canada/EU?

Scenarios

- Pet food/treats
 - Used in rations, but not directly fed to outbreak
 - Contaminate other rations?
 - Ingredient in base mixes?
 - Contaminate grinders/mixers?
- Complete feed swine base mixes/premixes
 - Associated with outbreaks (& normal herds)
 - No common brand unless produced under different labels or contaminated in truck or mill

Ongoing collaborations, studies and testing...

- Testing of archived samples:
 - Feral swine samples,
 - Human nasal swabs,
 - Pet treats
- Genetic epidemiology, virus relationships
- Sifting customs data
- Additional field epi data from index farms
- Trace index farm's feed and ingredients
- Monitor US sequences for novel viruses

Questions?

