PED – Epidemiology and risk factors for transmission in east Asia

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PED transmission in east Asia

- PED outbreaks commence in Korea – 1992
- Related outbreaks in east Asia
- Outbreaks in the Philippines started 2004

- New strains of PED outbreaks commence in PR China – 2008 – continue to present
- Related outbreaks spread across east Asia – Burma, Laos, Thailand

- USA outbreaks
PED epidemiology

• enveloped ssRNA virus
  – Frequent mutations

• Fecal shedding
  – Peak at 6 days p.i.
  – Some pigs (10 %) still shedding at 28 days p.i.

• Environmental survival
  – Feces and water – 7 days
  – Feeds, fomites, slurry etc – 14 to 28 days
PED virus groups – PR China
Huang et al 2013
Chinese PED survey – diagnostic labs 2012

Methods
Sampled 48 farms in PR China
756 piglet intestinal samples
Standard PED PCR assay

Results
426/756 positive (56%)
26/48 farms positive (54%)

9 of 426 samples culture positive
– sequence Orf 3
Orf 3 genogroup profiles

- Shanxi 1
- Zhejiang 6
- Ningxia 9
- Hebei 5
- Gaocheng 8
- CPF1074(HQ537456)
- CPF299(HQ537450)
- CH SHH 06(GU372740)
- CH S(GU372733)
- CH JL 08(GU372734)
- CH HNHJ 08(GU372736)
- CH HNCH 06(GU372738)
- BIF256(HQ537447)
- Zhejiang 4
- Beijing 5
- CH HLJM 07(GU372735)
- CH IMT 06(GU372735)
- CH JL 09(GU372741)
- BI1108(HQ537435)
- Chinju99(EU792474)
- DR13(EU054929)
- PFF1051(HQ537455)
- V2501(HQ537441)
- CH GSJII 07(GU372742)
- CH GSJII 07(GU372737)
- CH HLJH 06(GU372732)
- CH GSJIII 07(GU372743)
- CV777 vs
- DR13 vs((EU054930))
- M2366(HQ537440)
- Guangxi 12
- Shunxin 5
- M1595(HQ537436)
- CV777(AF353511)
- Brl 87
- LZC(EF185992)
Novel PED strains in Asia

- Several mutations and recombinations
- Enhanced transmission ability?
- Strong pathogenicity in challenge studies
Cross border PED transmission

• East Asia
  – Regional pig movements and transmission
  – Cross border trade in pigs and pig products
• Yunan area in PR China
• Related outbreaks spread across Burma, Laos, Thailand
Cross border PED transmission

• East Asia landmass
  – Regional pig movements and transmission

• Philippines 2004
  – Outbreaks initially linked to TGE
  – Moderate spread between farms
  – Severe disease, particularly in combination with US strains of PRRS
  – Recurring outbreaks with poor immunity
Philippines PED entry 2004

- No land border with other infected countries

- Suspect portal of 2004 entry = breeding pig entry from infected country (South Korea)

- Import pure lines from pedigree breeders for "in-house" genetic programs, usually at 30-50 kg

- No PED testing protocols
Local PED transmission in east Asia

- Trucks – pig and piglet collection
- Fomites
- Boars
- Injectable vaccines
- Feed?
PED – Pig and piglet collection trucks

Live - dead pig collection trucks and offal collection centers
PED - Piglet collection in Asia

Piglets are a food source in east Asia
Travelling Boars

- AI rarely used in east Asia
- Local boars and equipment move around between farms
Injectable pig vaccines in Asia

- Many local vaccine companies
- Government subsidised vaccine programs
- Lots of pig injections!!
- Farm storage and hygiene variable
## Typical vaccine program in east Asia – commercial farms

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Manufacturer examples</th>
<th>End-user price (RMB/dose)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudorabies</td>
<td>BI, DBN etc</td>
<td>3.6-4.0</td>
</tr>
<tr>
<td>M hyo</td>
<td>BI etc</td>
<td>8.5-9.5</td>
</tr>
<tr>
<td>Strep.</td>
<td>Guangdong biological factory etc.</td>
<td>0.04-0.08</td>
</tr>
<tr>
<td>CSF</td>
<td>Guangdong biological factory, CAHIC</td>
<td>0.03-0.05</td>
</tr>
<tr>
<td>Erysipelas</td>
<td>Guangdong biological factory etc.</td>
<td>0.028-0.03</td>
</tr>
<tr>
<td>Pasteurella</td>
<td>Guangdong biological factory etc.</td>
<td>0.03-0.05</td>
</tr>
<tr>
<td>Parvo</td>
<td>Harbin Vet. Institute etc.</td>
<td>0.8-1.2</td>
</tr>
<tr>
<td>TGE-PED</td>
<td>Harbin Vet. Institute etc.</td>
<td>3.8-4.0</td>
</tr>
<tr>
<td>JE</td>
<td>Shanghai Fengxian Vet. Station</td>
<td>2.2-2.5</td>
</tr>
<tr>
<td>E.coli</td>
<td>Shanghai Fengxian Vet. Station etc.</td>
<td>1.8-2.0</td>
</tr>
<tr>
<td>PRRS</td>
<td>CAHIC, HiLe, BI etc.</td>
<td>2.0-2.2</td>
</tr>
<tr>
<td>FMD</td>
<td>Lanzhou, JinYu Group</td>
<td>0.5-1.2</td>
</tr>
</tbody>
</table>
Injectable vaccine supply for 500 million pigs in PR China

PRC Ministry of Agriculture:
- operates and supplies 33,400 official veterinary stations that provide free compulsory vaccines in generic format, mainly to backyard and small producers
- FMD, PRRS and classical swine fever

Animal health companies and Distributors:
- PRC has around 300,000 animal health distributors (1 per 200 swine producers)
Pig production in PR China
500 million pigs

The largest 10 pig producing provinces

- Sichuan
- Hunan
- Henan
- Shandong
- Hubei
- Guangdong
- Guangxi
- Hebei
- Yunnan
- Jiangxi
 Compound pig feed supply in Asia

<table>
<thead>
<tr>
<th>Company</th>
<th>Headquarters (China)</th>
<th>Production (MMT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Hope (Liuhe)</td>
<td>Sichuan</td>
<td>13</td>
</tr>
<tr>
<td>CP Group</td>
<td>Beijing</td>
<td>9</td>
</tr>
<tr>
<td>Wenshi</td>
<td>Guangdong</td>
<td>5.14</td>
</tr>
<tr>
<td>Shuangbaotai</td>
<td>Jiangxi</td>
<td>4.7</td>
</tr>
<tr>
<td>Tongwei</td>
<td>Sichuan</td>
<td>3.35</td>
</tr>
<tr>
<td>East Hope</td>
<td>Shanghai</td>
<td>3</td>
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<tr>
<td>West Hope</td>
<td>Sichuan</td>
<td>2.5</td>
</tr>
<tr>
<td>Well Hope</td>
<td>Liaoning</td>
<td>2.2</td>
</tr>
<tr>
<td>Zhengbang</td>
<td>Jiangxi</td>
<td>2</td>
</tr>
<tr>
<td>Tieqilishi</td>
<td>Sichuan</td>
<td>1.75</td>
</tr>
</tbody>
</table>
The largest ten feed producing provinces account for 66% of total pig production.

Guangdong and Shandong provinces account for 23% of total pig production.

Figure: Top 10 feed producing provinces
Home mixing operations common

• 5% of farms (larger farms) prepare compound feed at farm level
• 25% of pig farms use home mix with range of by-products and ingredients
  – Fruit and vegetable oils, waste products
Asia farmer actions against PED

- Feed back of intestinal materials to breeding pigs. Whole herd exposure and quick immunity is aim.
- Harvest enough intestine material - Logistical problems.
- Recurrences are very common - 4 to 12 months later.
- PED strain effect?
- PRRS and CSF effect?
PED vaccine strategies in east Asia

• Attentuated strains – cell adapted virus
  – Japanese vaccine J-vac available
  – BUT - high frequency mutations
  – Reversion to virulence ?
  – Generally not successful

• Killed virus vaccines
  – Injectable KV

• Combinations
Killed and combination PED vaccines

• Vaccinate in houhai site midline GV01 acupuncture point between anus and tail
• Ha’arbin Pharmaceutical company – PR China
PED Asia transmission summary

- Infected breeding pigs
- Trucks – pig and piglet collection
- Fomites
- Boars
- Injectable vaccines
- Feed issues?

- USA entry?
  - Fomites
  - Feed
PED summary

- PED outbreaks common and important disease in east Asia
- PED has high mutation potential (ssRNA) leading to new genogroups
- Mutations in key genes may assist transmission?
- Trucks and other mechanisms aid local transmission
PED is important – how can we fix it