Coordinating Global Surveillance for Influenza in Swine

OFFLU – Swine Influenza Virus Group
2009 pH1N1 Lessons Learned

• Media, fear, trade, politics, etc., often ignored the science
• Geographic and host origins of virus unclear
  – Gaps in sequence data
• Mechanisms of human adaptation and virulence unclear
• Virus capable of infecting multiple host species but well adapted to swine and humans
  – Similar in phenotype to US endemic TRIG viruses
• Potential evolution of pH1N1 in multiple species unprecedented with current milieu of co-circulating viruses
• Swine influenza data underrepresented overall and absent in many regions
• Active and passive surveillance in swine exist in many regions, but mostly private or unreported and uncoordinated
• Our engagement with human influenza sector is critical
Peer Reviewed Publications on Influenza Epidemiology

PubMed Records

- Swine
- Avian
- Human

Swine | Avian | Human
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200 | 600 | 1400
Sequences in GenBank
Influenza Virus Resource

Full Length Gene Sequences

Whole Virus Genome Sequence Sets

Swine  Avian  Human

Swine  Avian  Human
Genetic Diversity of SIV in Southern China

Global influenza monitoring in swine

Benefits to Animal Health

• Surveillance for influenza viruses in pigs almost non-existent for decades.

• A global picture of the dominant SIV subtypes and lineages in different geographic regions of the world is needed.
  – Comparison between continents and regions, track major changes in the epidemiology, detect novel viruses in a timely manner.
  – Optimization of diagnostic techniques for SI and assist in the selection of SI vaccine strains.

• A better understanding of the antigenic and genetic evolution of SIVs over time.
  – Extent of genetic and antigenic drift of SIVs, mechanisms behind it, and significance to the immune response.
Global influenza monitoring in swine

Benefits to Animal Health

• Whole genome sequencing may reveal potential determinants of adaptation to pigs.

• Insight into the epidemiology at the regional and farm level.
  – Modes of transmission and the dynamics at the farm level.
  – Understanding human to swine transmission.

• Significance of SIV in acute respiratory disease outbreaks and contribution to porcine respiratory disease complex.

• A collection of viruses for applied and fundamental experimental research.
  – Surveillance is the foundation for relevant SIV research and vaccine development.
Global influenza monitoring in swine

Benefits to Public Health

• Timely identification of emerging viruses in pigs, birds, humans and other hosts.
  – Assess risks for mammalian and/or human adaptation.
• Objective and reliable data about the role of swine influenza as a zoonosis.
• Better insights into the role of pigs in influenza pandemics.
• Comparison of the influenza situation in swine and in humans.
  – Bi-directional sharing of information between human and animal health sectors
  – Preparation of potential human vaccine seed strains
Challenges to SIV surveillance globally

• Non-biased representative sampling is difficult.
  – Producer and veterinary participation voluntary
• Serologic surveillance of limited value.
  – Confounded by vaccine usage
  – Requires knowledge of local circulating strains
• Limited government infrastructure for non-reportable diseases.
• Lack of reference labs with SIV expertise in some high priority regions.
• Restrictions in sharing viruses between labs and countries.
  – Shipping restrictions due to endemic/exotic diseases.
  – Material transfer and proprietary issues

$$\text{Lack of funds in animal health sector for collection, sequencing, lab assays, banking viruses, generating sera, data management and analysis, research, etc.}$$ $$\text{Or SWINEFLU?}$$
High Priority Regions for Targeted Surveillance in Swine

Lina Awada, OIE

- Based on population density of swine, poultry, and water fowl, production intensity, import and export and regional movement patterns
Factors associated with influenza outbreaks in pigs

Factors associated with influenza outbreaks in pigs:
- Yellow: factors low
- Brown: factors high
- White: countries with low pig population
Factors associated with reassortment pig - wild waterfowl

- Light yellow: factors low
- Dark red: factors high
- Gray: countries with low pig population
Factors associated with reassortment pig - domestic poultry

- Yellow: factors low
- Red: factors high
- Light gray: countries with low pig population
Regions ranked by overall priority

Swine producing regions potentially more at risk for the emergence and spread of new influenza viruses in pigs:

- Dark red: outbreaks in pig populations + reassortment between viruses circulating in pigs and birds
- Red: outbreaks in pig populations + global spread
- Light red: reassortment between viruses circulating in pigs and birds
- Pink: outbreaks in pig populations, no export
- Light pink: reassortment between viruses circulating in pigs and birds, no export
- Yellow: countries with low pig populations
Surveillance only the first step

Good quality epidemiologic, virologic, and sequence data is the foundation.

Must be timely and tied to diagnostic updates.

Must be linked with sound data analysis and conclusions within the right context.

Valid research in lab and field also necessary.

Predicting and preventing future influenza epidemics and pandemics will require integrated and coordinated efforts between all influenza sectors.
OFFLU Swine Influenza Virus Group

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