Swine Flu Cases in the U.S.
Enhanced Surveillance & Zoonotic Transmission

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REASSORTMENT IN NATURE

• Genetic reassortment/drift common
• Swine: Both avian & human influenza
  – “Mixing vessel”= 2 or more influenza viruses can swap genes within an animal (particularly mixing different hemagglutinin and neuraminidases – creating a new subtype)
• Avian influenza
  – Conventional wisdom
    • No Avian→Human spread
  – New theory
    • Humans “mixing vessel” for influenza viruses
Novel Influenza A Virus Infections

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Novel Influenza A Virus Infections

- Humans infections with influenza A virus subtypes that are different from the currently circulating human subtypes (A/H1 and A/H3)—*more specifically* H3N2, H1N1
- Human infections with novel influenza A viruses transmissible person to person may signal the beginning of an influenza pandemic
Increased Capacity to Detect Influenza Virus Strains with Pandemic Potential

- Increased diagnostic capability at state public health laboratories
- New reporting requirements
- Enhanced capacity to identify and report novel influenza A virus infections
Recent Improvements in Influenza Diagnostic Capabilities

- Substantial pandemic planning resources devoted to improving PCR-testing capacity for novel influenza A at public health laboratories
  - Approximately 140 labs with RT-PCR capacity
- More labs can do subtyping than ever before
Recent Improvements in Influenza Diagnostic Capabilities

• Swine influenza viruses are often identified because they cannot be “subtyped” using standard methods and reagents
  – Labs advised to forward any “unsubtypables” to CDC to confirm
New Reporting Requirements for Novel Influenza A Virus Infections

• June 2007, CSTE added novel influenza A infections to the National Notifiable Disease Surveillance System (NNDSS)

• Reporting will facilitate prompt investigation and accelerate the implementation of effective public health responses
Novel Influenza A Virus Infection Case Definition (≠ nH1N1)

• Clinical Presentation
  – An illness compatible with influenza virus infection

• Laboratory Evidence
  – Infection with an influenza A virus subtype that is different from currently circulating human influenza H1 and H3 viruses. Novel subtypes include H2, H5, H7, and H9 subtypes, or H1 and H3 subtypes originating from a non-human species.

• Case Classification
  – Confirmed: A case of human infection with a novel influenza A virus confirmed by CDC’s influenza laboratory
  – Probable: A case meeting the clinical criteria and epi linked* to a confirmed case, but for which no lab testing for influenza virus has been performed
  – Suspect: A case meeting the clinical criteria, pending lab confirmation
Swine Influenza in the United States
Background

• Swine influenza first identified in 1930
• Endemic in pig herds throughout the world
  – Herd level seroprevalence 50 – 90%
  – Causes respiratory symptoms (cough, runny nose, lethargy, decreased feeding)
  – Secondary bacterial infections
• Herds often vaccinated
Influenza Viruses in U.S. Pigs

• 1918-1998
  – swH1N1 circulating in US swine herds
    • Little drift
• 1998 – H3N2 human/swine & H3N2 human/swine/avian reassortants identified in U.S. swine herds
• Since 1998, multiple introductions of human influenza viruses into swine herds with different reassortants
  – 1999- swH1N2 swine reassortant identified
  – swH1N1 reassortants subsequently identified
Interspecies Transmission of Swine Influenza

- Interspecies transmission well documented
    - CFR 6/35 (17%)
    - Known swine exposure in 22/36 (61%)
    - 5/14 unexposed- family cluster exposed to person with direct exposure
  - Person-to-person spread documented, though most “dead-end” transmissions
Serosurveys of Occupationally Exposed People

- 17% swine farmers, 11% vets (Myers, CID 2006)
- 23% swine farmers, (Olsen EID 2002)
- 7% vets, 13% abattoir workers vs. 0.4% general population (Schnurrenberger ARRD 1970)
Occupational Exposure

- Opportunity for direct and indirect contact
- Bio-security procedure is larger operations
Non-Occupational Exposure to Pigs

- Petting zoos
- Pot-bellied pigs
- Agriculture fairs
- Animal markets
Non-occupational Exposure to Pigs

- Venues provide potential for exposure by persons
  - Without pre-existing immunity
  - Immune compromised
Swine Influenza Infections in the U.S.

- 9 human cases of swine influenza identified since December 2005
  - Previously- 1 case q 1 – 2 years
  - All triple reassortant viruses
- Varying exposures and levels of investigation
### Summary of Human Swine Influenza Cases 2005 - 2008

<table>
<thead>
<tr>
<th>State</th>
<th>Age</th>
<th>Yr</th>
<th>Sx</th>
<th>Incubation period</th>
<th>Exposure to swine</th>
<th>Sick pigs</th>
<th>Investigated?</th>
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<tbody>
<tr>
<td>WI</td>
<td>17</td>
<td>05</td>
<td>ILI</td>
<td>? 7 days</td>
<td>Butchered swine</td>
<td>?</td>
<td>Yes</td>
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<tr>
<td>KS</td>
<td>7</td>
<td>06</td>
<td>URI</td>
<td>?</td>
<td>No direct exposure</td>
<td>?</td>
<td>No</td>
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<tr>
<td>IA</td>
<td>4</td>
<td>06</td>
<td>URI &amp; vomiting</td>
<td>7-10 days</td>
<td>?ill cousin, NDE</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>OH</td>
<td>10</td>
<td>07</td>
<td>ILI</td>
<td>3-4 days</td>
<td>Exhibitor at fair</td>
<td>Yes</td>
<td>Yes/No</td>
</tr>
<tr>
<td>OH</td>
<td>36</td>
<td>07</td>
<td>ILI</td>
<td>3-4 days</td>
<td>Exhibitor at fair</td>
<td>Yes</td>
<td>Yes/No</td>
</tr>
<tr>
<td>IL</td>
<td>49</td>
<td>07</td>
<td>ILI, severely ill</td>
<td>7 days</td>
<td>Visited fair, NDE</td>
<td>Yes</td>
<td>Yes/No</td>
</tr>
<tr>
<td>MI</td>
<td>1</td>
<td>07</td>
<td>ILI</td>
<td>7 days</td>
<td>Visited fair, NDE</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>IA</td>
<td>2</td>
<td>07</td>
<td>ILI</td>
<td>1-10 days</td>
<td>Multiple indirect exposure</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>MN</td>
<td>28</td>
<td>08</td>
<td>ILI, severely ill</td>
<td>9 days</td>
<td>Live animal market, NDE</td>
<td>Unknown</td>
<td>Yes</td>
</tr>
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</table>
Conclusions

• Capacity for of RT-PCR testing substantially improved in U.S. public health laboratories

• Increased reporting requirements

• Increase detection of swine influenza infections in humans over the past year
  – Unclear if increase in cases due to increased testing (subtyping) OR actual increase in human cases
Conclusions

• Wide variation in intensity of investigations and cooperation of state & local public health & agriculture authorities

• Need to establish & enhance collaboration between human & animal health agencies @ federal, state & local level
  – will enhance detection of novel influenza viruses
  – provide opportunities to respond & prevent further transmission events

• Investigations paramount to understanding transmission & developing recommendations for prevention
Novel Strain of H1N1 Influenza Virus

Is it human?

Is it avian?

Is it swine?
Novel Strain of H1N1 Influenza Virus

- Triple reassortment led to new influenza virus with a combination of human, avian, & swine sequences and Eurasian virus sequences
- This strain- prior to March 2009- not previously documented in humans
- All 8 gene segments have been known to circulate in swine
- Avian connection is because the viruses (both U.S. swine & Eurasian swine) originally came from birds, but are now swine adapted
- NOT thought now to readily infect or replicate well in birds
Novel Strain of H1N1 Influenza Virus

- Seasonal influenza vaccine: cross-protection potential is low
- CDC statement: little to no protection from the seasonal H1N1 vaccine
- CDC-immunology testing to see likelihood of finding cross-reaction between antibodies produced against new virus (different age groups will be examined) . . . pending, several weeks
Novel Strain of H1N1
WHO Update

• As of 06:00 GMT, 5 May, 2009
  – 21 countries have officially reported cases of new strain of influenza A/H1N1
• U.S.: 286 laboratory confirmed human cases, with 1 death
• Mexico: 590 confirmed human cases of infection including 25 deaths
• Canada: 140 laboratory confirmed human cases, with 0 deaths
• WHO Total: 1124
• WHO influenza pandemic alert = phase 5
Novel Strain of H1N1
WHO Update

- **China, Hong Kong, Special Administrative Region**: 1 laboratory confirmed human cases, with no deaths.
- **Costa Rica**: 1 laboratory confirmed human cases, with no deaths.
- **Colombia**: 1 laboratory confirmed human cases, with no deaths.
- **Denmark**: 1 laboratory confirmed human cases, with no deaths.
- **El Salvador**: 2 laboratory confirmed human cases, with no deaths.
- **France**: 4 laboratory confirmed human cases, with no deaths.
- **Germany**: 8 laboratory confirmed human cases, with no deaths.
- **Ireland**: 1 laboratory confirmed human cases, with no deaths.
- **Italy**: 2 laboratory confirmed human cases, with no deaths.
- **New Zealand**: 6 laboratory confirmed human cases, with no deaths.
- **Portugal**: 1 laboratory confirmed human cases, with no deaths.
- **Republic of Korea**: 1 laboratory confirmed human cases, with no deaths.
- **United Kingdom**: 18 laboratory confirmed human cases, with no deaths.
- **Israel**: 4 laboratory confirmed human cases, with no deaths.
- **Netherlands**: 1 laboratory confirmed human cases, with no deaths.
- **Spain**: 54 laboratory confirmed human cases, with no deaths.
- **Switzerland**: 1 laboratory confirmed human cases, with no deaths.
CDC Update for U.S.

• (As of May 5, 2009, 11:00 AM ET)
• TOTAL: 403 cases, 1 death, 38 states reporting lab confirmed cases
Arizona Stats- 2009 Influenza A (H1N1)

Summary of Case & Epidemiologic Information

As of 5/4/2009 2:00 pm

Confirmed: 17
- Counties: (4/15) Maricopa (9), Pima (6), Santa Cruz (1), Yuma (1)
- Number hospitalized: 3 (Mean Age: 8 Median Age: 9 Age Range: 3 years – 12 years)
- Case Demographics (Confirmed):
  - Age Range: 3 to 41 years Mean: 12 years Median: 11 years
  - Sex: Female 7 (41%), Male 6 (35%), Unknown 4 (24%)
  - Cases under 1 year of age: 0
  - Cases over 65 years of age: 0
  - Healthcare Workers: 0
  - Pregnant Women: 0
Arizona Stats- 2009 Influenza A (H1N1)
Summary of Case & Epidemiologic Information
As of 5/4/2009 2:00 pm

Unsubtypeable(s): 174
• Counties (8/15) Greenlee (1), La Paz (1), Maricopa (94), Pima (30), Pinal (23), Santa Cruz (1), Yavapai (3), and Yuma (21)
• Number Probable Cases Hospitalized: 2 Mean Age: 17 Median Age: 17 Age Range: 16 years – 18 years
• Case Demographics (Probable):
  • Age Range: <1 month – 74 years Mean: 17 years Median: 14 years
  • Sex: Male 75 (43%), Female 76 (44%), and Unknown 23 (13%)
  • Cases under 1 year of age: 2
  • Cases over 65 years of age: 2
  • Healthcare Workers: 0
  • Pregnant Women: 0
The End