Respiratory illness in a piggery associated with novel influenza A viruses: assessing the risk to human health

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Known influenza A infections in pigs in Australia

- First reported in 2009
- One outbreak in WA Jul 2011
- All acquired from humans

H1N1 (2009) pdm infections in pigs in Australia
Pig Deaths at WA Piggery by Day and Farm Site, July-Aug 2012

WA DOH notified
Timeline of Events

Friday 3 Aug – notified of possible influenza outbreak at a piggery in WA, some workers had recent mild respiratory tract infections

Saturday 4 Aug am – site visit and get pig swabs

Saturday 4 Aug pm – approx 20 pig samples tested at PathWest and initial PCR results indicated influenza A infection, unlikely to be the current seasonal H1 or H3 strains

Sunday 5/Monday 6 – Initial PCR results confirmed. Positive and some negative samples referred to WHOCC Melbourne and AAHL for further testing. Sequencing of PCR products commenced.

Wednesday 8 Aug - piggery worker with classic ILI – swabs taken – PCR indicated likely seasonal H3N2 – this event occurred in the middle of our influenza season – dominated by H3N2 and B

Friday 10 August - vaccination and oseltamivir clinic conducted

Friday 24 August - blood draws & more swabs
The viruses from WA pigs

- Two novel influenza viruses were isolated from pig samples at AAHL and WHOCC Melbourne and fully sequenced at both laboratories – they were distinct from those found in an outbreak in a Qld piggery, and zoonotic swine influenza infections occurring in the USA
- Other influenza A segments were sequenced at PathWest from PCR products - probable human H1N1pdm or possibly another reassortant

<table>
<thead>
<tr>
<th></th>
<th>HA</th>
<th>NA</th>
<th>M</th>
<th>PA</th>
<th>PB1</th>
<th>PB2</th>
<th>NP</th>
<th>NS</th>
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</thead>
<tbody>
<tr>
<td>H1N2tr (isolate)</td>
<td>H1N1 1983-96</td>
<td>H3N2 1970-03</td>
<td>H1N1 pdm</td>
<td>H1N1 pdm</td>
<td>H1N1 pdm</td>
<td>H1N1 pdm</td>
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<td>H1N1 pdm</td>
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<tr>
<td>H1N1pdm (PCR)</td>
<td>ND</td>
<td>H1N1 pdm</td>
<td>H1N1 pdm</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
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The pigs

- 131 pigs, mainly nose swabs, some tissue samples
  - PCRs directed at multiple targets, isolation
  - Sequencing from isolates and from PCR products
- 19.1% had confirmed or presumed H1N2tr
- 4.6% had confirmed or presumed H3N2r
- 10.7% had unsubtyped influenza A
- One mixed H1N1tr and H3N2r
Convalescent serology available for 21 piggery workers with illness

- Two unvaccinated individuals (a married couple) had evidence of recent H1N1 2009 infection
- Two vaccinated individuals had evidence of recent H1N1 2009 infection
- Two vaccinated individuals had evidence of recent seasonal H3N2 infection
- Others could not be interpreted
Illness survey among piggery workers

Responses from 69 of 70 workers.

Symptoms
- Cough ~ 70%
- Runny nose ~50%
- Sore throat ~35%
- Fever ~25%
The people

• Eight workers with influenza-like illness were swabbed for virus
  – One confirmed seasonal H3N2, three rhinoviruses

• 57 piggery workers bled
  – 4 had acute and convalescent sera, including the one confirmed case of seasonal H3N2 infection
  – 48 had received the seasonal influenza vaccine 2 weeks prior, including 3 of 4 with paired sera (excluding the confirmed seasonal H3N2 infection)
  – 9 had not received the seasonal influenza vaccine
HI titres in vaccinated piggery workers

- **H1N2tr**
  - 13% >= 160
  - 42% >= 40

- **H3N2r**
  - 35% >= 160
  - 77% >= 40
Zoonotic influenza, seasonal human influenza or vaccine responses?

• Was this due to infection with the reassortant viruses at some stage or due to the vaccinations?
• Ferret antisera raised to vaccine strains did not cross-react with the swine viruses
  – Suggests vaccination or seasonal infections may not cause cross-reacting antibodies to the novel viruses
• The four paired serum samples not helpful only showed vaccine responses (three), or response to proven seasonal H3N2 infection (one)
**Effect of seasonal vaccination on the HI titres to the pig influenza viruses**

<table>
<thead>
<tr>
<th>Virus Type</th>
<th>Unvaccinated</th>
<th>Vaccinated</th>
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<tr>
<td>WA H1N2tr</td>
<td>4.12 (2.92-5.32)</td>
<td>4.13 (3.58-4.69)</td>
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<tr>
<td>WA H3N2r</td>
<td>3.62 (1.21-2.42)</td>
<td>6.11 (5.52-6.71)</td>
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- Seasonal vaccination did not affect the HI titres to the H1N2tr, but did significantly increase the titres to the H3N2r.
- No adequate control group to determine whether these titres are higher than those seen in unvaccinated and vaccinated individuals without exposure to pigs.
Assessing the risk to human health

• No evidence of any immediate significant public health risk
  – No evidence of human illness due to swine viruses
  – No evidence of unexplained fever or respiratory illness outbreaks in piggery workers

• Suggests potential for commercial (and possibly “backyard” pigs) within Australia to act as potential mixing vessel for human and animal influenza => generate new pandemic strains
Implications

• No evidence of any immediate significant public health risk
  – No definitive evidence of human infection has occurred, but needs further investigation
  – No evidence of human illness due to these viruses
  – No evidence of unexplained fever or respiratory illness outbreaks in piggery workers

• Suggests that commercial (and possibly “backyard” pig) within Australia act as potential mixing vessel for human and animal influenza and could generate new pandemic strains
  – Needs more sampling and testing (PCR/culture/serology)

• Need to consider the risk to highly susceptible individuals who have contact with pigs

• Need to review the recommendations for influenza vaccination, antivirals and PPE for people in contact with pigs
Acknowledgements

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