The Epidemiology of Influenza in northern Australia

Aaron Weinman
Influenza

• Respiratory pathogen
• Protection through vaccination or natural infection
• Triggers seasonal epidemics and pandemics
# Pandemic influenza in the NT

<table>
<thead>
<tr>
<th></th>
<th>ACT</th>
<th>NSW</th>
<th>NT</th>
<th>QLD</th>
<th>SA</th>
<th>TAS</th>
<th>VIC</th>
<th>WA</th>
<th>AUS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total pandemic (H1N1)</strong> 2009 hospitalisations</td>
<td>43</td>
<td>1266</td>
<td>367</td>
<td>1241</td>
<td>501</td>
<td>106</td>
<td>419</td>
<td>878</td>
<td>4,844</td>
</tr>
<tr>
<td>Percentage of national pandemic (H1N1) 2009 hospitalisations</td>
<td>1%</td>
<td>26%</td>
<td>8%</td>
<td>26%</td>
<td>10%</td>
<td>2%</td>
<td>9%</td>
<td>18%</td>
<td>100%</td>
</tr>
<tr>
<td>Crude rate per 100,000</td>
<td>12.5</td>
<td>18.2</td>
<td><strong>166.8</strong></td>
<td>29.0</td>
<td>31.3</td>
<td>21.3</td>
<td>7.9</td>
<td>40.6</td>
<td><strong>22.7</strong></td>
</tr>
<tr>
<td><strong>Total pandemic (H1N1) 2009 deaths</strong></td>
<td>2</td>
<td>51</td>
<td>6</td>
<td>41</td>
<td>26</td>
<td>7</td>
<td>24</td>
<td>26</td>
<td>183</td>
</tr>
<tr>
<td>Percentage of national pandemic (H1N1) 2009 deaths</td>
<td>1%</td>
<td>28%</td>
<td>3%</td>
<td>22%</td>
<td>14%</td>
<td>4%</td>
<td>13%</td>
<td>15%</td>
<td>100%</td>
</tr>
<tr>
<td>Crude rate per 100,000</td>
<td>0.6</td>
<td>0.7</td>
<td><strong>2.7</strong></td>
<td>1.0</td>
<td>1.6</td>
<td>1.4</td>
<td>0.5</td>
<td>1.2</td>
<td><strong>0.9</strong></td>
</tr>
</tbody>
</table>

Data from Australian Institute of Health and Welfare Influenza Surveillance report, 3 October, 2009
Impact of Influenza on Indigenous Australians

Comparative hospitalisation rates

Comparative mortality rates

Marsden-Betts et al, unpublished
Need for further research

- National immunization program helps cover the cost of vaccination in Indigenous Australians <5 and ≥15
- Need to optimise program
- No studies on influenza in the NT have used phylogenetic methods

Markey et al. 2018
Need for further research

- No systematic assessment of vaccine effectiveness in the NT
- No information on community level protection given vaccine for NT communities
- Lack of recent data comparing morbidity and mortality of influenza in the NT to other areas

<table>
<thead>
<tr>
<th></th>
<th>Vaccine effectiveness</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indigenous Australians</td>
<td>-13%</td>
<td>(-194%, 56%)</td>
</tr>
<tr>
<td>Non-Indigenous Australians</td>
<td>53%</td>
<td>(30%, 69%)</td>
</tr>
</tbody>
</table>

Data from FluCAN system, 2011-2015
Key Objectives

1. To understand geographic, chronological, ethnic and phylogenetic patterns in the spread of influenza in northern Australia.
Obtain notifications of laboratory confirmed influenza (2007-2016)

Basic epidemiological analyses

Geographical mapping

Link patient samples to corresponding notification

Sequencing 500 samples

Phylogenetic analysis

Determine time taken for infection to spread, communities hardest hit and origin
Key Objectives

1. To understand geographic, chronological, ethnic and phylogenetic patterns in the spread of influenza in northern Australia.

2. To assess the effectiveness of the influenza vaccine and health care burden caused by influenza in Indigenous Australians in northern Australia.
Assessment of current vaccine effectiveness

- Obtained results of all influenza tests in the NT 2008-2014
- Conduct test-positive test-negative case-control study

Indigenous Australians seeking care for acute respiratory infection

Cases: Laboratory confirmation of influenza

Calculate number vaccinated

Calculate odds ratio

Vaccine effectiveness = 1 - odds ratio

Controls: Test negative for influenza

Calculate number vaccinated
Key Objectives

1. To understand geographic, chronological, ethnic and phylogenetic patterns in the spread of influenza in northern Australia.

2. To assess the effectiveness of the influenza vaccine and health care burden caused by influenza in Indigenous Australians in northern Australia.

3. To compare the protection against influenza offered by vaccination to the protection offered by natural infection at a community level.
Community level effects

- Build on results from Dr. James Trauer

Jan-May 2009: Baseline specimens taken

29 May 2009: pH1N1 begins circulating in the NT

Sep 2009: Post-pandemic specimens taken

30 Sep 2009 onwards: Vaccination campaign against pH1N1 begins in the NT

June 2010: pH1N1 re-emerges in the NT
Plan for study

Data from serosurvey on proportion immune + Vaccination data from NT CDC + ABS population denominators + Influenza notifications

Conduct correlational analyses

Compare protection from natural infection to vaccination
Key Objectives

1. To understand geographic, chronological, ethnic and phylogenetic patterns in the spread of influenza in northern Australia.

2. To assess the effectiveness of the influenza vaccine and health care burden caused by influenza in Indigenous Australians in northern Australia.

3. To compare the protection against influenza offered by vaccination to the protection offered by natural infection at a community level.

4. To compare the vaccine effectiveness and morbidity & mortality caused by influenza on Indigenous Australians in the NT to that in other areas of Australia
Assessing Influenza in Indigenous Australians

- Secured access to FluCAN data
- FluCAN system surveys influenza cases from 17 hospitals
- Repeat preliminary analysis of vaccine effectiveness
- Compare odds of severe outcomes for Indigenous and non-Indigenous Australians
- Compare odds of severe outcomes for Indigenous patients in different parts of Australia
Laboratory confirmed influenza cases in the NT
Data provided by: NT CDC (for objectives 1&3) or pathology providers (for objective 2)

Objective 1
- Virus samples from influenza cases
  Custodians: WHO CCRRI and PathWest
- Understand transmission dynamics of influenza in the NT

Objective 2
- Negative influenza tests
  Custodians: Pathology providers
- Primary care and hospitalisation data
  Custodian: NT Government
- Estimate effectiveness of influenza vaccine for Indigenous Australians in the NT on hospitalization and primary care

Objective 3
- Data from Dr. Trauer’s serosurvey on proportion immune to pH1N1
  Custodian: NT CDC
- Influenza vaccination records
  Custodian: NT CDC
- Compare protection from natural and artificial immunity for communities

Objective 4
- FluCAN data on influenza hospitalisations
  Custodian: Prof. Allen Cheng
- Estimate vaccine effectiveness against hospitalisation and burden of influenza on Indigenous Australians at a national level

The Peter Doherty Institute for Infection and Immunity
A joint venture between The University of Melbourne and The Royal Melbourne Hospital
Acknowledgements

The Peter Doherty Institute for Infection and Immunity:
A/Prof. Steven Tong
A/Prof. Sheena Sullivan
Dr. Yi-Mo Deng
Pina Iannello
Dr. Juliana Marsden-Betts
Dr. Katherine Gibney
Matthew Nguyen

Monash University:
A/Prof Vijay Dhanasekaran
Dr. Celeste Donato
Dr. James Trauer
Prof. Allen Cheng

Advisory committee:
• Prof. Katherine Kedzierska
• Prof. Jodie McVernon

NT CDC:
Dr. Peter Markey
Dr. Rosalind Webby
Dr. Vicki Krause
Christian James

PathWest:
• Dr. Avram Levy

HOT NORTH
Improving Health Outcomes in the Tropical North