Laboratory Support of the Influenza A H1N1(2009)

Public Health Response in Victoria

Dr. Mike Cation
Role of the Public Health Laboratory

in Infectious Diseases Outbreaks

- Develop and maintain appropriate laboratory capacity
- Surveillance and initial case finding.
- Diagnostic and reference testing supporting Public Health investigation.
- Timely notification of cases to Public Health Authorities
- Contribute to Public Health management decisions
- Research
Influenza A H1N1 (2009) in Victoria:

Phases of the Public Health Response

Detections of Influenza A H1N1 (2009) from Sentinel Surveillance Week Commencing
Pandemic Preparedness: VIDRL

- Throughput capacity
  - Planned surge capacity of 500+ extra PCR/day
  - Planned duration 2+ weeks then step down to clinical testing

- Facilities/Equipment
  - Dedicated outbreak facility
  - Nucleic acid extraction robotics + real time PCR analysers

- Staffing
  - 2 dedicated ‘surge’ EFT scientists
  - Secretaries cross trained on LIMS key entry
  - Additional support from ‘quiet’ laboratory areas

- Reagents
  - Stockpile of non-perishable reagents.
Laboratory Detection of Pandemic Influenza A

- Pooled nose and throat swabs
- Real-time PCR based detection
- Dual PCR primer sets
  - Matrix gene – detection of all 16 influenza subtypes
  - Haemagglutinin gene – differentiation of subtypes
- Referral to WHOCC for characterisation
- Prompted by 2 x US index cases 15 April:
  - Matrix & H1 PCR primers checked against H1N1 (2009) sequence
  - Specific H1N1 (2009) probe design
‘DELAY’ Phase
Influenza A H1N1 (2009) testing protocol: Victoria

Returned traveller with ILI

Triage by DHS

- Relevant travel history
- ILI (fever, cough, malaise)

Possible case

- Urgent Influenza A H1N1 (2009) test

Case rejected

- Respiratory multiplex PCR offered
Surge Capacity: Influenza A H1N1 (2009) PCR Throughput Viral Identification (VI)
Laboratory VIDRL – ‘CONTAIN’ Phase

* Each Specimen (red line) was tested for influenza. Influenza positives (bars) also had a second test for Swine Flu performed. Total tests (blue line) records numbers of both sets of tests.
Influenza A H1N1 (2009) PCR Throughput Viral Identification (VI) Laboratory VIDRL ‘SUSTAIN’ & ‘PROTECT’ Phases
Complementary Laboratory Activity:

(i) Clinically focussed testing during ‘SUSTAIN’ & ‘PROTECT’
(ii) Sentinel Surveillance Influenza H1N1 (2009) detections and ILI

![Graph showing influenza detections and ILI over time]
Influenza A Subtypes VIDRL Winter 2009

Flu A pos: 8 2 6 56 917 683 151 224 245 220 156 136 97 68 46 33 24 11 (n = 3083)

Swine (n = 2484, 80.6%)

Week 7 (08/06): Commenced modified sustain

H3 (n = 287, 9.3%)
H1 (n = 162, 5.3%)
DNT (n = 135, 4.9%)
Age Distribution of Influenza A Subtypes VIDRL Winter 2009
(Percentage of each subtype by age)
Age Distribution of Influenza A Subtypes VIDRL Winter 2009

(relative proportions of subtypes within each age-group)
Planning & Reality

Pandemic Preparedness

- Nominated surge test throughput capacity (500+ tests/day 2 + weeks)
- This capacity expected to meet surveillance and clinical needs
- Laboratory response planning built around this figure

Extent to which reality varied from expectation

- Negative results were important for action
- Expectations of testing for everyone
- Continuation of case finding despite community transmission

Extent to which planning succeeded

- Within laboratory
  - Data entry
  - Telecoms
  - Staff numbers
- External to laboratory
  - Specimen transport
  - Data transmission
  - Communications
  - Reagents

Success/Perceived Success Of Pandemic Preparedness
Expectation and Reality

- Negative results of influenza testing were important: cessation of antivirals and release from quarantine.
- Expectations from public/primary care of laboratory testing of all respiratory illnesses
- Continuation of case finding and laboratory testing despite widespread community transmission
## Success of Planning Within the Laboratory

<table>
<thead>
<tr>
<th>Plan</th>
<th>In Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Facilities</strong></td>
<td></td>
</tr>
<tr>
<td>- Outbreak specific PCR Laboratories</td>
<td>Worked well</td>
</tr>
<tr>
<td>- Dedicated outbreak specimen reception area</td>
<td>Not available during outbreak</td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
<td></td>
</tr>
<tr>
<td>- Nucleic acid extraction robotics</td>
<td>Worked well</td>
</tr>
<tr>
<td>- Real time PCR analysers</td>
<td>Worked well</td>
</tr>
</tbody>
</table>
**Success of Planning within the Laboratory**

<table>
<thead>
<tr>
<th>Plan</th>
<th>In Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Staffing</strong></td>
<td></td>
</tr>
<tr>
<td>2 additional multi-trained scientists</td>
<td>Extremely helpful, but still short-staffed</td>
</tr>
<tr>
<td>Supplementary staff from ‘quiet areas’</td>
<td>Quiet areas busy covering support staff tasks</td>
</tr>
<tr>
<td>Secretaries cross trained in data key entry</td>
<td>Not fast enough</td>
</tr>
<tr>
<td>Switchboard manning from ‘quiet areas’</td>
<td>Quiet areas busy</td>
</tr>
<tr>
<td><strong>Reagents</strong></td>
<td></td>
</tr>
<tr>
<td>Stockpile of non-perishable reagents</td>
<td>Ran critically low on perishable reagents (e.g., reverse transcriptase)</td>
</tr>
</tbody>
</table>
Influenza A H1N1 (2009) PCR Throughput Viral Identification (VI) Laboratory VIDRL ‘SUSTAIN’ & ‘PROTECT’ Phases
Mean Turnaround Times (hrs) Influenza A H1N1 (2009)

PCR VIDRL May-July

Mean Turnaround Times Influenza A H1N1 (2008 vs 2009)
The Testing Cycle

Clinical Care

- Patient
- Sampling
- Referral & Transport
- Data transmission
- Receipt & Entry
- Testing
- Reporting
- Laboratory
H1N1 (2009) Positive Samples: Transit times to VIDRL (Days)
## Victorian Aged Care Facility Respiratory Outbreaks Investigations: Laboratory Diagnoses

<table>
<thead>
<tr>
<th></th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picornaviruses</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>RSV</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Influenza A H3</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>9</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Influenza A H1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Influenza B</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1*</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>No diagnosis</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

* Adenovirus as part of a mixed outbreak with RSV & Flu A