Influenza surveillance in Victoria

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Clinical Vaccinology Update

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Doherty Institute
A joint venture between the University of Melbourne and Melbourne Health
Outline

• Influenza surveillance principles
• Overview of Victorian surveillance programs
• Influenza surveillance observations to date
• National comparisons
• Using surveillance data to estimate influenza vaccine effectiveness
Influenza surveillance challenges

• Wide clinical spectrum
  – Most commonly acute self-limited febrile illness with myalgia & cough
  – Asymptomatic → pneumonia

• Representativeness of influenza testing data
  – Many cases not laboratory confirmed
  – Subject to presentation and testing biases
  – Influenza-like illness (ILI) used as a proxy to measure influenza activity
    • Definition: cough + fever + fatigue
Victorian influenza surveillance system

• Laboratory confirmed influenza
  – Notifiable disease surveillance
  – GP sentinel surveillance
  – Routine laboratory testing (VIDRL)
  – Hospitalisations
  – Strain typing (WHO Collaborating Centre)

• Influenza-like illness (ILI)
  – GP sentinel surveillance
  – Locum service
Victorian influenza surveillance system objectives

• Monitor trends with respect to time, population groups, geography and other risk factors
• Characterise circulating influenza strains
• Monitor & evaluate impact of the vaccine program
• Detect and control outbreaks
• Guide policy, service provision, prevention strategies and other public health interventions
• Provide a basis for epidemiological research
Notifiable laboratory confirmed influenza

• Group B notifiable disease in Victoria
  – Notify in writing (within 5 days of diagnosis)
• Notifications required from doctors and laboratories
• Apply national case definitions
• Weekly surveillance analysis
Victorian Sentinel Practice Influenza Network (VicSPIN)

- Operational from May to November
- ~100 GPs
- Weekly reports of total patients and number presenting with ILI
- Nose/throat swab collected from ILI patients
- Laboratory testing
  - PCR testing for influenza type & subtype
Victorian Sentinel Practice Influenza Network (VicSPIN)
National Home Doctor Service (NHDS)

• 24 hour locum service
  – Melbourne and Geelong, expanded in 2014

• ILI proportions of total consultations calculated from those with ‘flu’ and ‘influenza’ keywords
  – Excludes records referring to vaccination
FluCAN

• Influenza Complications Alert Network
• 17 sentinel hospitals participating nationally
  – 4 in Victoria
  – Primarily adult patients
• Detailed data on patients hospitalised with influenza
  – Risk factors/comorbidities
  – Clinical data
Notified influenza cases & VicSPIN ILI consultation proportions

- Notified type A
- Notified type B
- VicSPIN ILI proportion
- NHDS ILI proportion

Year: 2007 to 2015

Number of notified cases

ILI per 1,000 consultations

Alert, Above Average, Average, Baseline
Notified influenza cases & VicSPIN ILI consultation proportions, 2015

Number of notified cases

Week ending

ILI per 1,000 consultations

Notified type A
Notified type B
VicSPIN ILI proportion
NHDS ILI proportion
Notified influenza cases by type and age group, 2015

Median age
Type A = 55 years
Type B = 42 years
Laboratory testing results from VicSPIN swabs, 2015

- Negative
- Influenza (untyped)
- Influenza A/H3N2
- Influenza A/H1N1
- % flu positive

Week ending:
- 3 May
- 17 May
- 31 May
- 14 Jun
- 28 Jun
- 12 Jul
- 26 Jul
- 9 Aug
- 23 Aug
- 6 Sep
- 20 Sep
- 4 Oct
- 18 Oct
- 1 Nov

Number of detections

Percent influenza positive
Laboratory testing results from routine respiratory swabs, VIDRL
FluCAN laboratory confirmed influenza cases, 2015

- **21 cases year-to-date**
  - 16 (76%) flu B
  - 14 (67%) female

- **Age**
  - Range: 21-88 years
  - Median = 58 years

- **1 (5%) ICU**

- **15 (71%) comorbidities**
Strain characterisation of Victorian influenza isolates

2015 vaccine

- A/California/7/2009 (H1N1)pdm09-like
- A/Switzerland/9715293/2013 (H3N2)-like
- B/Phuket/3073/2013-like (Yamagata)
Gaps in influenza surveillance

• Hospital emergency departments
• Hospitalisations
  – FluCAN restricted to four metro hospitals in Victoria
  – Other data sources not timely
• Mortality surveillance
• Capacity to collect from notified cases but requires follow up
National systems

- Australian Sentinel Practice Research Network (ASPREN)
- FluTracking (www.flutracking.net)
National Notifiable Diseases Surveillance System

Figure 2: Notifications of laboratory confirmed influenza, Australia, 1 January to 22 May 2015, by state or territory and week

Source: National Notifiable Diseases Surveillance System
Note: Each figure has a different vertical scale range
Flutracking Influenza-Like Illness symptoms fever and cough (Australia)
Australian Sentinel Practice Research Network (ASPREN)

Figure 4: Weekly rate of ILI reported from sentinel General Practitioner ILI surveillance systems, 1 January 2011 to 24 May 2015, by week

Source: Australian Sentinel Practices Research Network. Data from the Victorian Infectious Disease Reference Laboratory General Practitioner influenza-like illness surveillance system is included from May to October each year.
Estimation of 2014 influenza vaccine effectiveness

• 2014 seasonal trivalent influenza vaccine
  – A/California/7/2009 (H1N1)-like virus
  – A/Texas/50/2012 (H3N2)-like virus
  – B/Massachusetts/2/2012-like virus (B/Yamagata/16/88 lineage)

• Fully funded for those at high risk
  – ≥65 years
  – Aboriginal & Torres Strait Islander people ≥15 years
  – ≥6 months with medical condition predisposing to severe influenza
  – Pregnant women
Rationale and aim

• Rationale for regular influenza VE assessment
  – Vaccine licensed annually based on immunogenicity (rather than field) studies
  – Vaccine program evaluation
  – Different vaccine strains & circulation each year

• Aim
  – Assess effectiveness of 2014 seasonal influenza vaccine against laboratory confirmed influenza infection
**GP ILI presentations**

Swabbed

- Age
- Sex
- Symptom onset
- Vaccination
- Comorbidity

**PCR -ve**

**PCR +ve**

**Exclusions**

- Age
- Sex
- Symptom onset
- Vaccination
- Comorbidity

**Controls**

**Cases**

**VE = [1 – OR] x 100%**

- Adjust for age, time, comorbidity
- Stratify by type/subtype and age group
VE study participants

169,491 patients seen

660 (0.4%) with ILI

516 (78%) swabbed

170 influenza positive Cases (40%)
  98 A/H1N1
  61 A/H3N2
  5 A/unspecified
  6 type B

257 influenza negative Controls (60%)

89 (17%) excluded
  Unk vaccination status (n=14)
  Unk symptom onset date (n=28)
  >7d symptoms to swab (n=55)
  Influenza type C (n=3)
  Outside risk period (n=60)
### Vaccinated cases and controls

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Vaccinated (%)</th>
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<tbody>
<tr>
<td>Controls</td>
<td>257</td>
<td>82 (32)</td>
</tr>
<tr>
<td>A/H1N1</td>
<td>98</td>
<td>22 (22)</td>
</tr>
<tr>
<td>A/H3N2</td>
<td>61</td>
<td>19 (31)</td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td>0 (0)</td>
</tr>
<tr>
<td>All influenza</td>
<td>170</td>
<td>41 (24)</td>
</tr>
</tbody>
</table>

Cases younger than controls ($p=0.004$)
Older patients more likely to be vaccinated ($p<0.001$)
## Adjusted influenza VE (95% CI) by type*/subtype and age group†

<table>
<thead>
<tr>
<th></th>
<th>18-64</th>
<th>≥65</th>
<th>All ages</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/H1N1</td>
<td>32 (-28, 64)</td>
<td>34 (-800, 95)</td>
<td>23 (-40, 58)</td>
</tr>
<tr>
<td>A/H3N2</td>
<td>10 (-105, 61)</td>
<td>65 (-578, 98)</td>
<td>3 (-105, 54)</td>
</tr>
<tr>
<td>All influenza</td>
<td>31 (-18, 60)</td>
<td>32 (-386, 91)</td>
<td>22 (-29, 53)</td>
</tr>
</tbody>
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* Not calculated for type B because all six cases were unvaccinated (VE = 0%)
† Not calculated for <18 because all 35 controls were unvaccinated (VE = -∞%)
Limitations

• Low power for stratified VE estimates
• Generalisability
  – GP-attended ILI
  – Working age adults
• Potential biases and unmeasured confounding
  – Cannot measure previous infection or vaccination
  – Unbiased VE estimates under general assumptions

Jackson *Vaccine* (2013)
Foppa *Vaccine* (2013)
Conclusions

• Mild season despite high notifications
  – Supported by other surveillance data

• Relatively low VE (22% for all flu)
  – Circulating & vaccine strains antigenically matched

<table>
<thead>
<tr>
<th>Subtype</th>
<th>Vaccine strain</th>
<th>Circulating strain</th>
<th>VE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/H1N1</td>
<td>A/California/7/2009</td>
<td>A/California/7/2009 (99%)</td>
<td>23%</td>
</tr>
<tr>
<td>A/H3N2</td>
<td>A/Texas/50/2012*</td>
<td>A/Texas/50/2012 (99%)</td>
<td>3%</td>
</tr>
</tbody>
</table>

* Cell reference strain; low reactors to egg-grown strain

– Inconsistent with other community studies
  • A/H1N1: NZ (73%); ASPREN (57%), WA (61%), Europe 2014/15 (~70%)
  • A/H3N2: Sthn hemisphere (-84 to 36%)
Acknowledgements

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Questions

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