Effectiveness of pertussis maternal vaccination in preventing disease in infants: a NSW case-control study

Nathan Saul, Kevin Wang, Shopna Bag, Jane Thomas, Meena Chandra, Priscilla Stanley, Heather Baldwin Vicky Sheppeard, Stephen Conaty, on behalf of the NSW Public Health Network pertussis working group
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Introduction

- Acute bacterial disease of the respiratory tract, caused by *Bordetella pertussis*. Highest risk in infants aged <6 months. Periodic outbreaks every 3 to 4 years
- Some evidence that vaccination during pregnancy is the best way to protect infants before their first pertussis vaccination at six weeks
- Increase in notifications in 2014
Methods

- **Aim:** estimate the effectiveness of third trimester vaccination at protecting infants compared to those not vaccinated during pregnancy

- **1:1 matched case control study, 117 matched pairs (N = 234)**

<table>
<thead>
<tr>
<th>Cases</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory confirmed infant 0 to 5 months of age</td>
<td>Infants randomly selected from public hospitals</td>
</tr>
<tr>
<td>Resident in Local Health District (LHD) in NSW or ACT</td>
<td>Born in the same LHD ±3 days of the case</td>
</tr>
</tbody>
</table>

- Cases and controls interviewed by public health unit staff – demographic, clinical and exposure history collected

- Odds ratios (OR) generated through conditional logistic regression (SAS)

- Vaccine effectiveness (VE) = (1 – OR)%

Results

< 6 months (n = 234, or 117 matched pairs)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds Ratio</th>
<th>Standard Error</th>
<th>p-value</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal vaccination status (vaccinated vs not)</td>
<td>0.61 (39%)</td>
<td>0.154</td>
<td>0.1124</td>
<td>(0.34, 1.12)</td>
</tr>
<tr>
<td>Breastfeeding status (exclusively breastfed vs mixed)</td>
<td>0.60</td>
<td>0.159</td>
<td>0.1097</td>
<td>(0.32, 1.12)</td>
</tr>
<tr>
<td>Household sizes</td>
<td>1.38</td>
<td>0.100</td>
<td>0.0012</td>
<td>(1.14, 1.68)</td>
</tr>
<tr>
<td>Week of gestation (≥ 37 weeks vs &lt; 37 weeks)</td>
<td>0.46</td>
<td>0.282</td>
<td>0.1716</td>
<td>(0.15, 1.40)</td>
</tr>
</tbody>
</table>

< 3 months (n = 96, or 48 matched pairs)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds Ratio</th>
<th>Standard Error</th>
<th>p-value</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal vaccination status (vaccinated vs not)</td>
<td>0.31 (69%)</td>
<td>0.534</td>
<td>0.0263</td>
<td>(0.11, 0.87)</td>
</tr>
<tr>
<td>Breastfeeding status (exclusively breastfed vs mixed)</td>
<td>0.22</td>
<td>0.320</td>
<td>0.0169</td>
<td>(0.06, 0.76)</td>
</tr>
<tr>
<td>Household sizes</td>
<td>2.07</td>
<td>0.269</td>
<td>0.0088</td>
<td>(1.22, 3.51)</td>
</tr>
</tbody>
</table>

Hospitalised cases (n = 74, or 37 matched pairs)

<table>
<thead>
<tr>
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<th>Standard Error</th>
<th>p-value</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal vaccination status (vaccinated vs not)</td>
<td>0.06 (94%)</td>
<td>0.475</td>
<td>0.0038</td>
<td>(0.01, 0.41)</td>
</tr>
<tr>
<td>Breastfeeding status (exclusively breastfed vs mixed)</td>
<td>0.11</td>
<td>0.507</td>
<td>0.0317</td>
<td>(0.02, 0.83)</td>
</tr>
<tr>
<td>Household sizes</td>
<td>1.94</td>
<td>0.285</td>
<td>0.0199</td>
<td>(1.11, 3.39)</td>
</tr>
</tbody>
</table>
Conclusion

- Maternal pertussis vaccination is highly effective at preventing severe disease (hospitalisation) in infants (VE = 94%) – suggests vaccine is more effective against severe disease than infection
- Also significantly effective at protecting against disease in infants under 3 months old (VE = 69%)
- Less effective at protecting against mild disease (VE = 39%)
- Indicates that the current policy of maternal vaccination in each pregnancy is protective for young infants

Acknowledgements

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  - Kevin Wang
  - Meena Chandra
  - Nathan Saul
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  - Shopna Bag
  - Stephen Conaty
  - Vicky Sheppeard
- Advisory Committee:
  - Claire Pearson, Sydney PHU
  - Mark Ferson, SES PHU
  - Nathan Saul, CD8
  - Paula Spokes, CD8
  - Peter McIntyre, NRHS
  - Stephen Conaty, SWS PHU
  - Vicky Sheppeard, CD8
- Site coordinators:
  - Carol George
  - Chabela Torres
  - Claire Pearson
  - Di Lovatt
  - Jane Thomas
  - Jane Jeffs
  - Kathy Denniss
  - Keira Glasgow
  - Kelly-Anne Ressler
  - Meena Chandra
  - Paul Cook
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