PERTUSSIS LABORATORY DIAGNOSIS

Important considerations
- There are several laboratory tests available for the diagnosis of pertussis
  - PCR should be performed in preference to culture
  - Serology is only useful later in the disease course
- The timing of a test impacts on its sensitivity
- A negative test does not necessarily rule out pertussis – consider exposure, clinical compatibility, and the diagnostic test performed and its timing

Timing of Infectivity, Laboratory Testing, and Treatment of Cases

<table>
<thead>
<tr>
<th>Week</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disease Phase</td>
<td>Catarrhal</td>
<td>Paroxysmal</td>
<td></td>
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<tr>
<td>Infectious</td>
<td>PCR</td>
<td>Culture</td>
<td>Serology</td>
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<tr>
<td>Treat Cases</td>
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First Symptoms 
Paroxysmal / Severe Cough Start Date
~5-10 days after first unwell – infectious for a further 3 weeks

Adapted from CDC: [www.cdc.gov/pertussis/clinical/diagnostic-testing/diagnosis-confirmation.html](http://www.cdc.gov/pertussis/clinical/diagnostic-testing/diagnosis-confirmation.html)
Shading indicates relative sensitivity

Diagnostic Test Performance

Test performance varies by study, particularly for PCR as laboratory methods have been refined over time and varies between studies. This table provides a reasonable guide.

<table>
<thead>
<tr>
<th></th>
<th>Culture</th>
<th>PCR</th>
<th>Serology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>15.2%</td>
<td>93.5%</td>
<td>47%</td>
</tr>
<tr>
<td>Specificity</td>
<td>100%</td>
<td>97.1</td>
<td>85%</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>100%</td>
<td>84.3%</td>
<td>41%</td>
</tr>
<tr>
<td>Negative predictive value</td>
<td>87.5%</td>
<td>98.9%</td>
<td>88%</td>
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</tbody>
</table>

Polymerase Chain Reaction (PCR)
- PCR is more sensitive as culture with the same specificity
  - When symptoms of classic pertussis are present (e.g. 2 weeks of paroxysmal cough) PCR is 2-3 times more likely than culture to be positive
- Routinely available across the Auckland Region from Labtests and LabPlus

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2 Chia J, et al. Comparison of multi-plex PCR, culture, and serology
• Performed on a flocked nasopharyngeal swab placed in viral transport media

Culture
• Only useful during the catarrhal and very early paroxysmal phase
• Lower sensitivity compared to PCR
• Routinely available across the Auckland Region from Labtests and LabPlus
• Performed on a charcoal nasopharyngeal swab

• Culture sensitivity is reduced by antibiotic treatment, immunisation, time since onset of symptoms, delay in transportation to the laboratory

Serology
• Serology is only useful late in the course of the illness, generally when the patient is no longer infectious, providing retrospective diagnosis
• Serology is not useful in the 12 months after vaccination as the antibody response following vaccination mimics that following infection
• Positive IgG results include
  o A single IgG titre against anti-pertussis toxin in the context of a recent clinically compatible illness and in the absence of immunisation in the preceding 12 months. Consider pertussis in the presence of the following local laboratory results:
    o IgG Moderate Positive: 31-60 BU/ml
    o IgG Strong Positive: >61 BU/ml
  o A four-fold rise in IgG between acute and convalescent sera taken 4-6 weeks apart in the absence of recent immunisation
• IgA assays lack adequate sensitivity and specificity and should not be used for diagnosis

Nasopharyngeal Swab Technique
• Gently insert the nasopharyngeal swab into the nostril until it reaches the posterior nasopharynx
  o there may be a slight resistance as the swab passes the turbinates
  o if there is more than slight resistance do not force the swab but try the other nostril
• Leave the swab in place for a few seconds.
• Gently withdraw the swab and place into transport medium immediately
• Note it is common for the tickling sensation of the swab to produce a cough or sneeze and it is useful to have a paper tissue handy.