**INTRODUCTION**

The current pertussis case classification system may underestimate the true burden of disease. Cases testing positive for pertussis by PCR but not meeting clinical case definition cannot be classified as either confirmed or probable and are therefore not reported to the CDC. Many such individuals likely represent true pertussis infections with clinical illness but are misclassified and therefore missing from state and national surveillance data.

**OBJECTIVE**

Compare 2007-2011 PCR-positive suspect cases with confirmed pertussis cases reported in Washington (WA) State to determine differences in:

- Demographics
- Symptoms
- Measures of severity, outcome & antibiotic treatment
- Vaccination status

**METHODS**

**Pertussis Case Classification Methods**

- **National Case Definition:**
  - Confirmed
    - Isolate Pertussis (Bp) cough of any duration, OR
    - Detect Bp DNA by PCR + clinical case definition, OR
    - Link to lab-confirmed case + clinical case definition
  - Probable
    - Meets clinical case definition BUT
    - No Bp isolation or Bp DNA detected by PCR AND No link to a lab-confirmed case
  - Suspect
    - a person whose initial symptoms suggest pertussis AND subsequent testing is negative OR no testing done OR cough duration < 2 weeks or cough duration undetermined
    - Bp PCR-positive persons who do not meet clinical case definition
    - For case & contact management, persons should be treated as if they had pertussis

**Analysis**

- Presence of clinical symptoms, treatment, outcomes, and vaccine receipt among PCR-positive suspect cases were compared to those among confirmed cases reported in WA with onsets from 2007-2011.
- Ascertainment of Vaccination Status. Vaccine dose dates entered in case report were used to calculate the number of doses received prior to onset. The variables for “Ever received pertussis vaccine?” and/or “Number of doses received prior to illness onset” were used to determine if no vaccine doses had been received prior to onset.
- Up-to-date for vaccine was defined as the minimum number of doses of pertussis-containing vaccine recommended for age by the Advisory Committee on Immunization Practices.
- Antibiotic Treatment Definitions. Early antibiotic treatment was defined as receipt of an appropriate antibiotic for pertussis which was received within one week of disease onset. Late antibiotic treatment was defined as 1) an appropriate antibiotic received greater than one week after onset OR 2) an inappropriate antibiotic received at any time.
- x² test of independence (or Fisher’s exact test) and t-test were performed in univariate analyses.

**RESULTS**

- **Pertussis Cases in WA, 2007-2011**

<table>
<thead>
<tr>
<th>Total case reports</th>
<th>Confirmed</th>
<th>PCR+</th>
<th>Suspect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confirmed cases:</td>
<td>2,276 (73%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Probable cases:</td>
<td>519 (17%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suspect cases:</td>
<td>309 (10%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Among suspect cases, 150 (49%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Demographic Characteristics of Confirmed and PCR+ Suspect Cases, 2007-2011**

- **Age group (years)**
  - <1: 16% (17%)
  - 1-4: 16% (18%)
  - 5-9: 17% (17%)
  - 10-17: 28% (30%)
  - 18-44: 15% (12%)
  - 45-64: 7% (4%)
  - ≥65: 1% (2%)
  - Male: 47% (55%)

- **Residence (region)**
  - Western WA: 84% (83%)

- **Race**
  - White: 87% (90%)
  - Black: 4% (4%)
  - American Indian: 2% (1%)
  - Asian: 2% (2%)
  - Other: 5% (3%)
  - Hispanic: 19% (18%)

- **Vaccination Status**
  - Up-to-date for age: 57% (55%)

**Comparison of Clinical Symptoms, Outcomes, Antibiotic Treatment and Vaccine Receipt, 2007-2011**

<table>
<thead>
<tr>
<th>Clinical Symptoms</th>
<th>Confirmed</th>
<th>PCR+</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-week cough*</td>
<td>99%</td>
<td>32%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Paroxysmal cough*</td>
<td>90%</td>
<td>38%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Post-tussive emesis*</td>
<td>54%</td>
<td>19%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Whoop</td>
<td>36%</td>
<td>15%</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

- **Antibiotic Treatment**
  - Receipt of appropriate antibiotic for pertussis: 94% (98%)<p><0.05
  - Onset to receipt of appropriate antibiotic (mean ± SD): 16 ± 9
  - Onset to early treatment with appropriate antibiotic: 22% (62%)<p><0.0001

**SUMMARY**

- Of 309 suspect cases identified in Washington State from 2007-2011, 150 (49%) were associated with a positive pertussis PCR assay.
- PCR-positive suspect & confirmed cases differ markedly in symptoms, but are otherwise similar in age, gender, race and ethnicity, severity of illness, outcome, and up-to-date vaccine status.
- PCR-positive suspect cases were treated significantly earlier with an appropriate antibiotic than confirmed cases, which may have modified cough duration and presence of other case-defining symptoms.
- The current case definition may result in an underestimation of the true burden of pertussis. A new case definition could consider inclusion of PCR-positive cases as “probable cases” when 2-week cough, epidemiologic link, or association with an outbreak are not present.
- Next steps:
  - Evaluate pertussis PCR cycle threshold values by classification method from tests performed at Washington State Public Health Laboratories.
  - Continue to monitor trends in PCR-positive suspect case reports in Washington State.