Update on Pertussis in Orange County

Overview

Pertussis (whooping cough) is caused by the *Bordetella pertussis* bacteria. Pertussis cases occur every year, with epidemics occurring approximately every 3-5 years in communities around the country. Given that the most recent California epidemics occurred in 2010 and 2014, a new epidemic seems likely to occur in the near future. Pertussis rates began to increase in Orange County at the end of the last school year in spring before decreasing during the summer months. Orange County Public Health (OCPH) will be monitoring pertussis rates closely in the coming months to see if rates increase again with school restarting.

Pertussis in Infants and Maternal Vaccination

Severe pertussis disease is primarily seen in infants under 6 months of age. 16 cases in this age group have accounted for only 12% of cases but 83% of hospitalizations in Orange County cases in 2018 (see Table 1). Adolescent and adult illness rarely requires hospitalization, but these populations serve as a community reservoir for the bacteria.

Of 8 pertussis cases in infants ≤2 months of age, only one (13%) had a mother who received Tdap (tetanus, diphtheria, acellular pertussis) vaccination at the appropriate period during pregnancy. Tdap is recommended for all pregnant women during weeks 27-36 weeks of gestation for each pregnancy. The effectiveness of maternal Tdap vaccination in preventing infant disease is clear, with multiple studies estimating an effectiveness of up to 93% in preventing disease.* On a statewide and local level, however, immunization rates for pregnant women are disappointing. According to a recent survey just over 50% of pregnant women in Orange County received Tdap at the correct time during pregnancy, which is similar to rates seen around the country.

*Studies evaluating effectiveness of maternal vaccination in preventing newborn pertussis:


California Maternal and Infant Health Assessment, 2016, can be found at: https://www.cdph.ca.gov/Programs/CFH/DMCAH/MIHA/Pages/Data-and-Reports.aspx
Pertussis Symptoms

The hallmark of pertussis disease is a prolonged cough. Illness severity can vary widely, with mild symptoms more likely in those who were previously vaccinated. After an incubation period of 5-21 days, persons with classic disease will pass through three phases of illness:

- **Catarrhal stage:** Onset of cold-like symptoms (coryza, sneezing, occasional cough). Fever is absent or minimal. This stage lasts approximately 1-2 weeks with cough gradually becoming more severe.
- **Paroxysmal stage:** Spasms of severe coughing occur, often followed by a sudden deep inspiration resulting in a characteristic “whooping” sound. Post-tussive vomiting is commonly seen.
- **Convalescent stage:** Decreasing frequency and severity of coughing, whooping and vomiting. Coughing paroxysms may recur with subsequent respiratory infections. Classic pertussis is 6-10 weeks in duration, but cough may last longer in some people.

Infants may present with different symptoms, particularly in the first months of life. Cough may be mild or absent, replaced by prominent gagging, gasping or apnea.

Pertussis Transmission

Pertussis is highly contagious. Transmission typically occurs when a susceptible person inhales aerosolized droplets from the respiratory tract of an infected person. Transmission via contact with fomites is thought to occur rarely, if ever. Persons ≥1 year of age are considered infectious from the onset of cold-like symptoms until after 5 days of treatment or until 21 days after cough onset if no (or partial) treatment is given. Infants < 1 year are considered infectious for 6 weeks without treatment.

Daycare and School Exclusion

Children attending daycare should be excluded from the setting until 5 days of appropriate antibiotic treatment (or if no treatment, 21 days after cough onset for ≥1 year olds or 6 weeks for <1 year olds). The American Academy of Pediatrics (AAP) and Centers for Disease Control and Prevention (CDC) also recommend excluding schoolchildren under these same guidelines. OCPH counsels that schools adhere to this recommendation when made by a medical provider. However, the effectiveness of this measure is uncertain in preventing spread of disease, given that school-age cases in Orange County are diagnosed on average two weeks after infectious coughing begins and the likelihood that a significant proportion of pertussis cases go undiagnosed in this population. In line with California Department of Public Health Guidance, when disease is widespread in the community, OCPH will allow cases who have started but not completed 5 days of antibiotic treatment to attend school if they are well enough to participate in school activities.

### Table 1. 2018 Orange County Pertussis Cases by Age Group.

<table>
<thead>
<tr>
<th>Pertussis by Age Group</th>
<th>2018 Cases (YTD)</th>
<th>Cases Hospitalized</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#</td>
<td>%</td>
</tr>
<tr>
<td>0 to 2 months</td>
<td>8</td>
<td>6%</td>
</tr>
<tr>
<td>3 to 5 months</td>
<td>8</td>
<td>6%</td>
</tr>
<tr>
<td>6 to 11 months</td>
<td>12</td>
<td>9%</td>
</tr>
<tr>
<td>Over 1 year</td>
<td>111</td>
<td>80%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>139</td>
<td>100%</td>
</tr>
</tbody>
</table>
Diagnosis

The primary method of diagnosis of pertussis is polymerase chain reaction (PCR) testing of a sample obtained by aspiration or swabbing of the posterior nasopharynx. PCR has optimal sensitivity during the first 3 weeks of cough when bacterial DNA is still present in the nasopharynx.

Treatment

Antimicrobial therapy generally does little to alleviate symptoms, but does make an infected person noninfectious more quickly (See table 2 for treatment options).

Pertussis Postexposure Prophylaxis

CDC and AAP recommend that all close contacts to pertussis cases receive PEP. Orange County Public Health will focus its efforts in providing prophylaxis to cases in contact with infants under one year of age.

Pertussis Vaccination is Recommended for all Children

Clinicians should give five doses of diphtheria, tetanus, and acellular pertussis (DTaP) to children 2 months through 6 years of age, and one dose of Tdap at 11 or 12 years of age. The CDC also recommends Tdap for pregnant women during each pregnancy, with a preferred administration during the early part of gestational weeks 27 through 36. For more information on pertussis vaccination, see https://www.cdc.gov/vaccines/vpd/dtap-tdap-td/hcp/index.html.

Management of Healthcare Workers Exposed to Pertussis

Healthcare workers with unprotected (i.e., unmasked) exposure to pertussis cases may be managed in two ways:
1. They may be offered PEP; or
2. They may self-monitor for symptoms for 21 days from the time of exposure.

Decisions on whether to offer PEP or initiate symptom watch should take into consideration the patient population served by the HCW and the likely frequency of exposures. PEP would likely be preferred over symptom watch for HCWs in a neonatal intensive care unit. Symptom watch may be preferred for HCWs who work in settings where repeated exposures are likely, such as an emergency department or pediatric clinic.

Pertussis is a reportable disease. All suspect or confirmed cases should be reported to OCPH at 714-834-8180.

For additional information, see the California Department of Public Health Quicksheet found at: https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/Immunization/PertussisQuicksheet.pdf.
### RECOMMENDED TREATMENT AND POSTEXPOSURE PROPHYLAXIS, BY AGE GROUP

<table>
<thead>
<tr>
<th>Age group</th>
<th>Azithromycin</th>
<th>Erythromycin*</th>
<th>Clarithromycin</th>
<th>Alternate agent: TMP-SMX†</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1 month</td>
<td>Recommended agent for infants &lt;1 month of age; 10 mg/kg per day in a single dose x 5 days§.</td>
<td>40–50 mg/kg per day in 4 divided doses x 14 days.</td>
<td>Not recommended.</td>
<td>Contraindicated in infants &lt;2 months of age (risk for kernicterus).</td>
</tr>
<tr>
<td>1–5 months</td>
<td>10 mg/kg per day in a single dose x 5 days.</td>
<td>See above.</td>
<td>15 mg/kg per day in 2 divided doses x 7 days.</td>
<td>Contraindicated in infants &lt;2 months of age. For infants aged ≥2 months of age, TMP 8 mg/kg per day, SMX 40 mg/kg per day in 2 divided doses x 14 days.</td>
</tr>
<tr>
<td>Infants aged ≥6 months and children</td>
<td>10 mg/kg as a single dose on day 1 (maximum 500 mg); then 5 mg/kg per day as a single dose on days 2–5 (maximum 250 mg/day).</td>
<td>40 mg/kg per day in 4 divided doses for 7-14 days (maximum 1-2 g per day).</td>
<td>See above (maximum 1g/day).</td>
<td>See above.</td>
</tr>
<tr>
<td>Adolescents and adults</td>
<td>500 mg as a single dose on day 1 then 250 mg as a single dose on days 2–5.</td>
<td>2g/day in 4 divided doses x 14 days.</td>
<td>1g/day in 2 divided doses x 7 days.</td>
<td>TMP 320 mg/day, SMX 1600mg/day in 2 divided doses x 14 days.</td>
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</table>


*Some experts prefer erythromycin estolate over erythromycin stearate or ethylsuccinate because it achieves higher serum levels with equal doses.
†Trimethoprim-sulfamethoxazole (TMP-SMX) can be used as an alternative agent to macrolides in patients ≥2 months of age who are not pregnant or nursing and are allergic to, cannot tolerate, or are infected with a rare macrolide-resistant strain of *B. pertussis*.
§Preferred macrolide for this age because of risk of idiopathic hypertrophic pyloric stenosis associated with erythromycin.

From CDPH Pertussis Quicksheet

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### Graph 1. Pertussis in Orange County Residents, 2008 to 2017

[Bar graph showing pertussis cases from 2008 to 2017 in Orange County residents]