



# Pertussis: Public Health Investigation

## Clinical symptoms

**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 are followed by a sudden deep inspiration, often resulting in a characteristic “whooping” sound. Post-tussive vomiting is common in all ages. Illness may be milder in previously vaccinated people.

Infants <1 year of age (particularly very young infants) may present differently:

- may have a shorter catarrhal stage
- may gag, gasp or stop breathing (apnea)
- facial color changes (may turn blue, purple or red)
- may not have noticeable cough or “whoop”
- likely to have leukocytosis (high white blood cell count) with an increased absolute lymphocyte count

**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.

## Modes of 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.

## Incubation period

Typically 7-10 days (range 5-21 days).

## Period of communicability

Persons  $\geq 1$  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).

## CDPH case definitions

### Confirmed case

- Acute cough illness of any duration with isolation of *B. pertussis* from a clinical specimen (culture positive); **or**
- Meets the clinical case definition AND is PCR positive for pertussis; **or**
- Meets the clinical case definition AND is a contact of a laboratory-confirmed pertussis case.

### Probable case

- Meets the clinical case definition, is not laboratory-confirmed and is not epidemiologically linked to a laboratory-confirmed pertussis case; **or**
- FOR INFANTS <1 YEAR OF AGE ONLY:
  - Acute cough illness of any duration and at least one of the following: whoop, paroxysm, post-tussive vomiting or apnea (with or without cyanosis) AND PCR positive for pertussis; **or**
  - Acute cough illness of any duration and at least one of the following: whoop, paroxysm, post-tussive vomiting or apnea (with or without cyanosis) AND is a contact of a laboratory-confirmed pertussis case

### Suspect case

- Acute cough illness of any duration AND is PCR positive for pertussis; **or**
- Acute cough illness of any duration and at least one: whoop, paroxysm or post-tussive vomiting AND is a contact of a laboratory-confirmed pertussis case

## Clinical case definition

In the absence of a more likely diagnosis, a cough illness lasting  $\geq 2$  weeks with at least one of the following:

- Paroxysms of coughing;\* or
- Inspiratory “whoop;” or
- Post-tussive vomiting; or
- Apnea $\pm$  (with or without cyanosis) (FOR INFANTS <1 YEAR OF AGE ONLY)

\*Sudden uncontrollable “fits” or spells of coughing where one cough follows the next without a break for breath.

$\pm$ Transient cessation of respiration occurring spontaneously or after a coughing spasm. Apnea is generally associated with cyanosis or syncope and might be accompanied by bradycardia. Apnea is a common pertussis symptom in infants and might be the only presenting sign of pertussis in young infants with no cough but is rarely associated with pertussis in older children and adults.

## CDC laboratory criteria for diagnosis

Isolation of *B. pertussis* from clinical specimen or positive polymerase chain reaction (PCR) test for *B. pertussis*. PCR has optimal sensitivity during the first 3 weeks of cough when bacterial DNA is still present in the nasopharynx.

For more [information on laboratory testing](https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/Immunization/PertussisLabTesting.pdf), please see: <https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/Immunization/PertussisLabTesting.pdf>

## Serologic testing for pertussis

Commercially available serologic tests have unproven or unknown clinical accuracy and their use is not recommended.

LHD staff receiving serological test results for pertussis may consider informing the ordering provider that PCR testing is the preferred diagnostic method for pertussis.

A single high titer of IgG or IgA antibodies to pertussis toxin (PT) is reasonably sensitive and specific when an ELISA test is used if the most recent pertussis vaccination was >2 years prior. In general, antibody titers to FHA are not interpretable.

### **Case and contact investigation**

1. Confirm that the known or suspected case meets the pertussis case definition or is highly suspected.
  - a. Obtain basic clinical information available at the time of the interview; follow-up to assess cough duration for case classification is not needed.
  - b. For infant cases <4 months of age or cases requiring hospitalization, more detailed information on the clinical course, hospitalization, and mother's Tdap vaccination history and case's DTaP vaccination history should be obtained.
2. Ensure that the case has been recommended to receive antibiotic treatment if it is <21 days since cough onset (see recommendations on page 4).
3. Determine if the case has any high-risk contacts (see definition of high-risk contact).
  - a. In general, only high-risk contacts should be recommended to receive antibiotic postexposure prophylaxis (PEP).
  - b. Identifiable high-risk contacts are typically those in the case's household or childcare setting; if the case is a healthcare worker, there could also be high-risk contacts in a healthcare setting.
  - c. Recommend PEP for high-risk household members (see recommendations on page 4).
  - d. Obtain contact information for identifiable high-risk contacts who are not in the case's household.
  - e. Follow-up on identifiable high-risk contacts outside of the case household and recommend PEP (see recommendations on page 4).
  - f. High-risk contacts should receive PEP as soon as possible and <21 days of last exposure to the infectious case.
  - g. Instruct high-risk contacts to seek medical attention if early symptoms of pertussis develop.
4. Advise lower-risk household and childcare contacts to monitor for symptoms and seek treatment if symptoms develop; follow-up of such contacts is not necessary.
5. For cases who are K-12 students, please record name of school case attends.
  - a. Other than pregnant staff or students, contacts in a K-12 school setting are typically lower-risk and do not require PEP.
  - b. LHJs may choose not to do notification of individual contacts in the K-12 school setting unless there is a known high-risk contact.

- c. LHJs may consider notification of the case's school.
6. Recommend vaccination for all persons who are not up-to-date for pertussis vaccine, using Tdap for people >7 years of age who have not already received it.
7. When pertussis incidence is high in the community and it is difficult to follow-up on all cases, LHJs may choose to prioritize investigation of cases in infants <1 year, children aged 1-12, and women of childbearing age.
  - a. Infants are at highest risk of severe pertussis and may have other infant contacts.
  - b. Younger children may be more likely to have pregnant mothers, infant siblings or other infant contacts.
  - c. Women of childbearing age may have an infant or be pregnant in their third trimester.
8. Alert clinicians and educate the public as indicated.

### **Close contact definition**

Close contacts are defined as persons with exposure to a pertussis case where contact with respiratory aerosols is likely. The duration and intensity of exposure needed to cause infection are unclear.

Being a household member, attending or working in the same childcare setting, receiving a cough or sneeze in the face, performing a medical examination of the mouth, nose or throat, sitting at adjacent desks or the same table at school, or sharing a confined space with an infectious person for >1 hour are generally considered significant exposures.

### **High-risk close contact definition**

Contacts at the highest risk of severe disease or of transmitting disease to high-risk people should be prioritized for PEP. High-risk contacts include:

- Infants <1 year of age, particularly infants <4 months of age who have not yet received any doses of DTaP;
- Pregnant women in their third trimester;
- Caregivers and household contacts of infants (e.g., family members, friends, or babysitters who spend time caring for an infant); and
- All those attending or working in a childcare setting (i.e., same room) *if* there is an infant or a pregnant woman in her third trimester in the setting.

### **Management of cases in childcare settings**

- Exclude case from the setting until 5 days of appropriate antibiotic treatment (or 21 days after cough onset if no treatment).
- Notify parents/guardians and staff about pertussis signs and symptoms, prevention and control measures, and who is considered a high-risk contact. Consider active surveillance for cough illness and exclusion of those with cough until evaluation by healthcare provider.

### **Management of cases in K-12 school settings when pertussis is known to be widespread in the community**

- LHJs should instruct schools about management of pertussis cases so that cases are handled uniformly in schools across the jurisdiction.
- The CDC and the American Academy of Pediatrics recommend school exclusion for children with pertussis until they have completed 5 days of antibiotic treatment. However, many cases will be undiagnosed and untreated and the benefit of school exclusion of known cases is unclear. In these situations, LHJs may consider permitting 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.
- School exclusion of unvaccinated students is generally not indicated.
- LHJs should assist with pertussis communications to the school community. Communications should include:
  - The signs and symptoms of pertussis;
  - Information about acellular pertussis vaccines and waning immunity;
  - The recommendation that pregnant staff and students should receive Tdap vaccine at the earliest opportunity between 27-36 weeks gestation; and
  - Information that infants <1 year of age are at the highest risk of severe pertussis and that the healthcare providers of high-risk household members, including infants <1 year and pregnant women in their third trimester, should be contacted to discuss PEP.
- Neither CDC nor CDPH has a pertussis outbreak definition; while pertussis outbreaks (as defined by LHJs) are reportable to CDPH, such reporting does not need to be prioritized and can be done in aggregate.

### **Management of exposed healthcare workers**

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 in to consideration the patient population served by the HCW and the likely frequency of exposures, e.g., PEP would likely be preferred over symptom watch for HCWs in a neonatal intensive care unit, but symptom watch may be preferred for HCWs in a pediatric clinic where repeated exposures are likely.

### **Post-exposure chemoprophylaxis (PEP)**

With increasing incidence and widespread community transmission of pertussis, extensive contact tracing and broad use of PEP among contacts is not an effective use of limited public health resources or appropriate antibiotic stewardship.

While antibiotics may prevent pertussis if given prior to symptom onset, there are no data to indicate that widespread use of PEP among contacts effectively controls or limits the scope of pertussis outbreaks. Therefore, LHJs should focus PEP efforts on infants <1 year of age and their contacts since serious complications and death are primarily limited to young infants.

- CDC and AAP currently recommend PEP for all household contacts, regardless of age or immunization status, because secondary attack rates in households are high even among vaccinated persons. However, CDPH considers it reasonable to prioritize PEP only to high-risk contacts or households, as noted above.
- Lower-risk contacts who have not received PEP should be instructed to monitor themselves closely for cold-like symptoms for 21 days after last exposure and contact their healthcare provider if symptoms occur so that antibiotic treatment can be implemented immediately.
- If pertussis is not widespread in the community, broader use of PEP may be considered in limited closed settings; however, if exposure is ongoing, multiple courses of PEP are not recommended.
- If 21 days have elapsed since last exposure to an infectious case, PEP has limited value but should be considered for households with high-risk contacts.
- See table on page 4 for recommended agents and dosing by age of patient for both PEP and treatment.

### **Pertussis vaccines**

- The primary DTaP series is essential for reducing severe disease in young infants. During a community outbreak, infants can receive DTaP on an accelerated schedule with the first dose given at 6 weeks of age, and at least 4 weeks between each of the first 3 doses.
- Even one dose of DTaP may offer some protection against fatal pertussis in young infants so accelerating even the first dose may be beneficial.
- All pregnant women should receive Tdap vaccine during every pregnancy regardless of pertussis vaccination history, preferably at the first opportunity between 27-36 weeks gestation to maximize the maternal antibody response and passive antibody transfer to the infant.
- All persons in contact with infants should be up-to-date for pertussis vaccine. Although only one dose of Tdap is recommended by ACIP for nonpregnant adolescents and adults, persons may choose to be revaccinated if it has been several years since receipt of Tdap.
- Immunity to pertussis from vaccine or disease wanes over time and persons who have been vaccinated or had disease can become infected. Data on duration of protection from acellular vaccines suggest that waning occurs within several years of vaccination, particularly in persons who have never received whole-cell vaccine.

**RECOMMENDED TREATMENT AND POSTEXPOSURE PROPHYLAXIS, BY AGE GROUP<sup>a</sup>**

<i>Age group</i>	<i>Azithromycin</i>	<i>Erythromycin*</i>	<i>Clarithromycin</i>	<i>Alternate agent: TMP-SMX†</i>
Younger than 1 month	10 mg/kg/day as a single dose daily for 5 days <sup>b,c</sup>	40 mg/kg/day in 4 divided doses for 14 days	Not recommended	Contraindicated at younger than 2 months
1 through 5 months	10 mg/kg/day as a single dose daily for 5 days <sup>b</sup>	40 mg/kg/day in 4 divided doses for 14 days	15 mg/kg/day in 2 divided doses for 7 days	2 months or older: TMP, 8 mg/kg/day; SMX, 40 mg/kg/day in 2 doses for 14 days
6 months or older and children	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 through 5 (maximum 250 mg/day) <sup>b,d</sup>	40 mg/kg/day in 4 divided doses for 7-14 days (maximum 1-2 g per day)	15 mg/kg/day in 2 divided doses for 7 days (maximum 1 g/day)	2 months or older: TMP, 8 mg/kg/day; SMX, 40 mg/kg/day in 2 doses for 14 days
Adolescents and adults	500 mg as a single dose on day 1, then 250 mg as a single dose on days 2 through 5 <sup>b,d</sup>	2g/day in 4 divided for 7-14 days	1g/day in 2 divided doses for 7 days	TMP 320 mg/day; SMX, 1600 mg/day in 2 divided doses for 14 days.

From: The American Academy of Pediatrics Red Book 2018-2021 Report of the Committee on Infectious Diseases.

TMP indicates trimethoprim; SMX, sulfamethoxazole.

<sup>a</sup>Centers for Disease Control and Prevention. Recommended antimicrobial agents for the treatment and postexposure prophylaxis of pertussis: 2005 CDC guidelines. MMWR Recomm Rep. 2005;54(RR-14):1-16

<sup>b</sup>Azithromycin should be used with caution in people with prolonged QT interval and certain proarrhythmic conditions.

<sup>c</sup>Preferred macrolide for this age because of risk of idiopathic hypertrophic pyloric stenosis associated with erythromycin.

<sup>d</sup>A 3-day course of azithromycin for PEP or treatment has not been validated and is not recommended.