



MAINE CDC: PERTUSSIS GUIDE FOR HEALTH CARE PROVIDERS

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Background

What is Pertussis?

Pertussis is a respiratory illness commonly known as whooping cough and has also been called “the 100-day cough”. *Bordetella pertussis* bacteria cause illness by attaching to the cilia of the upper respiratory system and releasing toxins. The toxins damage the cilia and cause airways to swell. *B. pertussis* is a fastidious, gram-negative, pleomorphic bacillus that produces multiple antigenic and biologically active products including adenylate cyclase, agglutinogens, filamentous hemagglutinin, pertactin, pertussis toxin, and tracheal cytotoxin.

Communicability

Pertussis is highly communicable. Up to 80% of susceptible household contacts of symptomatic infants become infected with *B. pertussis*.

Spread

Pertussis is typically spread from person to person via large respiratory droplets, typically generated by coughing or sneezing. Transmission via fomites is a theoretical possibility but is thought to happen rarely, if ever.

Incubation Period

Symptom onset can range from 5 to 21 days after exposure, but typically develop 7 to 10 days after exposure.

Infectious Period

People who have pertussis are infectious from cough onset until 21 days after cough onset, or until completing 5 days of antibiotic treatment.

Temporal Pattern

Though pertussis has no distinct seasonal pattern, incidence may increase in the late summer and fall.

Immunity

Neither natural infection nor immunization provide lifelong immunity.

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Disease Progression

Timeline of Illness

Pertussis symptoms vary by stage of illness. ([Figure 1](#)).

Pertussis often appears like a common cold. This commonly includes runny or stuffy nose, low-grade fever, and mild occasional cough.

One to two weeks after symptoms start, paroxysms, also known as coughing fits, may develop. Coughing fits this stage of illness can last up to 10 weeks, but usually lasts between 1 to 6 weeks. The cough generally gets worse and becomes more frequent during this stage of illness.

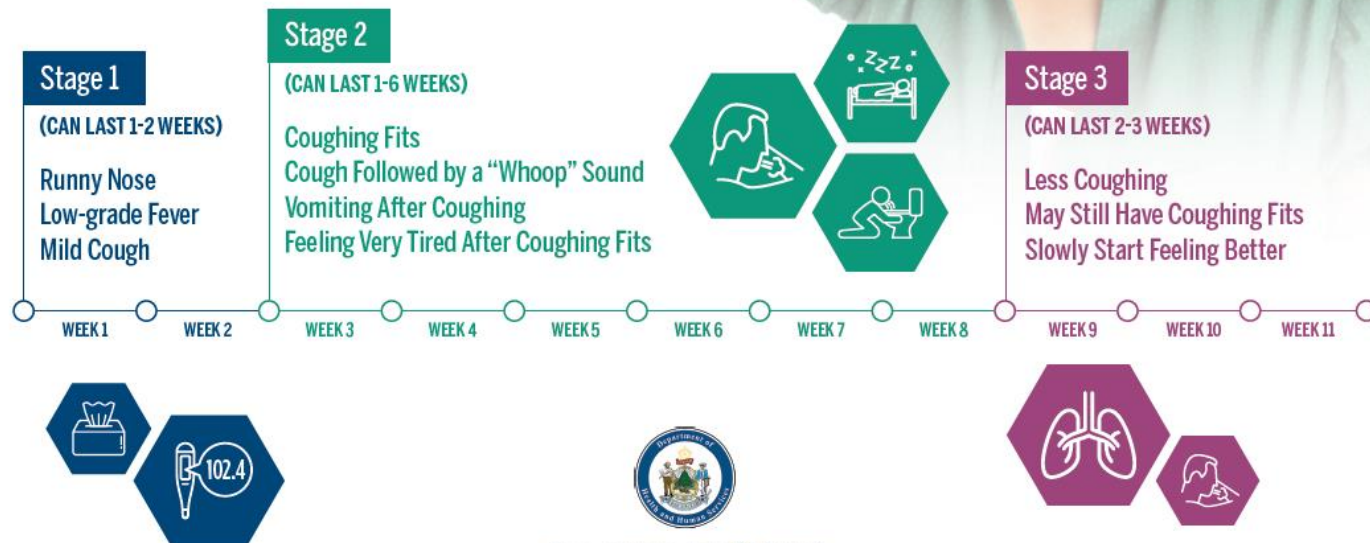
Coughing fits can cause people to make a high-pitched, “whoop” when they inhale after a coughing fit, vomit during or after coughing fits, but may seem well in-between fits, have difficulty sleeping at night due to increased night-time coughing fits, struggle to breathe, or fracture a rib.

People feel very tired after the fit but may seem well in-between fits. Those who experience these coughing fits may say it is the worst cough of their life.

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Figure 1: Timeline of Pertussis Disease Progression

A VISUAL TIMELINE OF Pertussis Symptoms (Whooping Cough)



Learn more at www.maine.gov/dhhs/pertussis

Variance in Disease Presentation

Infants (<1 year): Many infants with pertussis will not have a cough. Apnea, life-threatening pauses in breathing, is more common in infants. Apnea may cause cyanosis, or the infant may struggle to breathe. For some infants, pertussis may seem like a common cold for the entire illness.

Vaccinated Persons: People who have been vaccinated can still become infected with pertussis. When vaccinated individuals get pertussis their illness is generally mild in comparison to that of unvaccinated individuals.

Complications

Infants and children: Pertussis can cause serious, sometimes deadly, complications in infants and children. Infants and children who haven't had all recommended pertussis containing vaccines are more likely to experience serious complications. **Serious complications are common:** about 1 in 3 infants younger than 1 year old who get pertussis require hospital treatment. The younger the infant the more likely the child is to require hospital treatment. Infants younger than 1 year old who are treated in the hospital may have: apnea (68%), pneumonia (22%), convulsions (2%), and encephalopathy (0.6%).

Teens and adults: Complications can occur in teens and adults, but they are usually less serious, especially if the individual has been vaccinated. Some individuals may require hospital treatment.

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Prevention

Vaccination

There are 2 vaccines available that provide protection against pertussis: DTaP (diphtheria, tetanus, and acellular pertussis) and Tdap (tetanus, diphtheria, and acellular pertussis).

U.S. CDC recommends:

- Children receive a primary series of DTaP at 2,4, and 6 months, a booster between 15 and 18 months, and an additional booster between 4-6 years.
- Preteens should receive their first dose of Tdap between 11-12 years of age.
- Pregnant people should receive Tdap during weeks 27-36 of each pregnancy. Vaccine during this period of pregnancy helps provide immunity to the newborn who cannot receive their first vaccine until 2 months of age.
- Adults who have never received Tdap should get a dose of Tdap. Adults should also receive a Tdap booster every 10 years.

[Figure 2](#) summarizes this information.

Figure 2: U.S. CDC Pertussis Vaccine Recommendations

People of all ages need WHOOPING COUGH VACCINES



DTaP
for young children

- ✓ 2, 4, and 6 months
- ✓ 15 through 18 months
- ✓ 4 through 6 years

Tdap
for preteens

- ✓ 11 through 12 years

Tdap
for pregnant women

- ✓ During the 27-36th week of each pregnancy

Tdap
for adults

- ✓ Anytime for those who have never received it

www.cdc.gov/whoopingcough



Post-Exposure Prophylaxis

Antibiotic post-exposure prophylaxis can help prevent close contacts of the ill individual from becoming ill. The antibiotic regimen for pertussis post-exposure prophylaxis is the same as the treatment regimen.

Post-exposure prophylaxis is recommended for all household contacts. Providers who diagnose a patient with pertussis may prescribe antibiotic prophylaxis for household contacts that are asymptomatic and may choose to treat symptomatic household members with the same antibiotic regimen. While asymptomatic household members can continue to attend work/school, symptomatic contacts should isolate until they have completed 5 days of antibiotic treatment, or until 21 days have passed since cough onset.

Maine CDC epidemiologists will interview the ill individual or their parent/guardian to assess the individual's infectious period and to identify other individuals who should seek post-exposure prophylaxis. This will include high-risk contacts such as pregnant people, especially those in the third trimester of pregnancy; infants; immunocompromised individuals; individuals with a chronic respiratory condition that increase risk of severe respiratory illness; and individuals that have regular close contact with infants or expect to. Maine CDC may also recommend prophylaxis for other contacts depending on the situation, proximity, and duration of exposure.

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Testing

When to Test

Pertussis can be difficult to diagnose, and diagnostic testing is a valuable tool. Testing should not be performed on asymptomatic patients because it increases the risk of a false positive result. Providers should compare the expected timeline of pertussis illness ([Figure 1](#)), to the patient's timeline of symptoms. It may be helpful to consider if the patient's symptoms have already peaked when evaluating a patient with a cough onset within the last one to two weeks. While other common respiratory illnesses such as the common cold, influenza, COVID-19, and RSV commonly peak between days 3 through 5, pertussis typically peaks between weeks 2 through 8. Co-infection is possible, and pertussis can be most difficult to diagnose in early stages, highlighting the importance of laboratory testing. Pertussis may become more apparent in later stages. When providers suspect pertussis, they should collect a specimen prior to treatment.

Preferred Method of Testing: PCR

Polymerase Chain Reaction (PCR) testing is the preferred method of testing for pertussis due to the increased sensitivity and faster turnaround time compared to culture. The PCR test requires collection of a nasopharyngeal specimen using a polyester or flocked swab, or a nasopharyngeal wash or aspirate. Please check with your laboratory to determine the preferred specimen. PCR testing has optimal sensitivity in the first 3 weeks of cough but can be used through the 4th week with less reliability.

PCR testing for pertussis is available at the Maine Health and Environmental Testing Laboratory (HETL). The pertussis PCR testing at HETL detects *B. pertussis*, *B. parapertussis*, and *B. holmesii*. When sending specimens to HETL, reference the LSIS for specimen requirements.

PCR testing is also widely available at commercial laboratories. When ordering PCR testing from commercial laboratories providers should be aware of test limitations. Many PCR tests available at commercial labs are unable to distinguish between *B. pertussis* and *B. holmesii*. Research indicates that the level of false positive pertussis results caused by *B. holmesii* is small enough to continue using the pertussis PCR a reliable diagnostic tool (Cole et al., 2024).

Non-Preferred Tests

Culture and serologic testing are available at commercial laboratories however they are not preferred methods of testing.

Culture was previously considered the “gold standard” for diagnosis of pertussis, but is not optimally sensitive, and regularly takes up to 7 days to obtain results. This often leads to a delay in treatment.

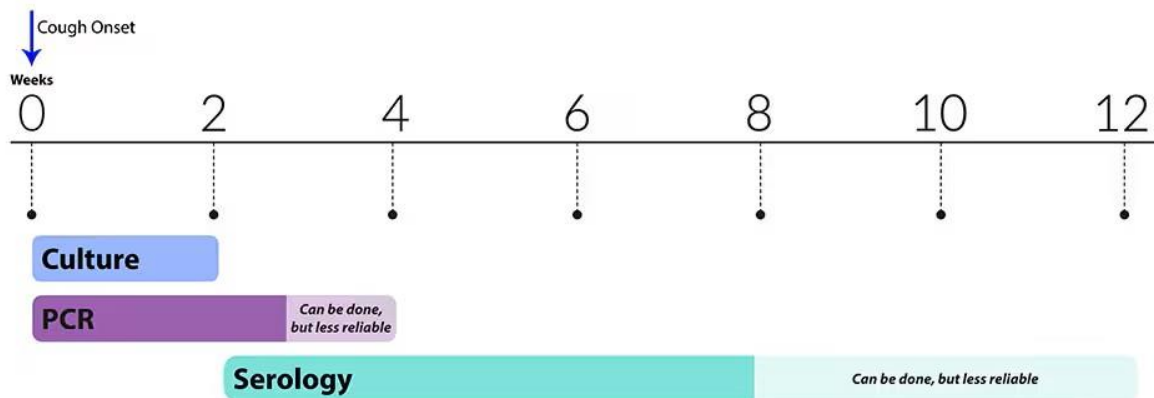
Serologic tests can be helpful for diagnosis late in illness, particularly after 3 weeks of illness. However, some commercially available tests have unproven or unknown clinical accuracy.

Timing of Testing

Timing is important for all available diagnostic tests for pertussis. [Figure 3](#) shows the optimal timing for each test. The preferred test, PCR, is optimal from cough onset through week three of illness. PCR may be used during week 4 of illness with less reliability.

Figure 3: Optimal Timing for Pertussis Diagnostic Testing

Optimal Timing for Pertussis Diagnostic Testing



cdc.gov/pertussis



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Treatment

Timing of Treatment

The earlier someone with pertussis starts treatment the better. Treatment is most effective when given before paroxysms have begun in the first two weeks of illness. After paroxysms have begun treatment is unlikely to reduce symptom severity. Treatment within three weeks of cough onset is broadly recommended. When treatment is provided within three weeks of cough onset, spread of illness is reduced even when symptoms are not. Infants younger than 1 and pregnant people (especially if near term) should receive treatment if cough onset was in the previous 6 weeks.

Antibiotic Selection

It is very important to treat pertussis early, before coughing fits begin. Treating pertussis early can make the illness less severe and help prevent spread of bacteria to others. **Azithromycin, clarithromycin, and erythromycin** are antibiotic options that have been recommended for treatment of pertussis or post-exposure prophylaxis. **Trimethoprim-sulfamethoxazole** may be used as an alternative for people who have a contraindication to or cannot tolerate macrolides. Treatment options vary by age.

For infants under 1 month of age, azithromycin is preferred, treatment with erythromycin and clarithromycin are not recommended. Azithromycin should be used with caution due to association between orally administered azithromycin with infantile hypertrophic pyloric stenosis (IHPS). However, azithromycin remains the drug of choice for treatment or prophylaxis of pertussis in very young infants. The risk of developing severe pertussis and life-threatening complications outweighs the potential risk of IHPS. Infants <1 month of age who receive a macrolide should be monitored for development of IHPS and other serious adverse events.

For people 1 month of age and older, macrolides (azithromycin, clarithromycin, and erythromycin) are preferred for the treatment of pertussis.

For people 2 months of age and older, macrolides (azithromycin, clarithromycin, and erythromycin) are preferred for the treatment of pertussis. Trimethoprim-sulfamethoxazole may be used as an alternative for people who have a contraindication to or cannot tolerate macrolides.

Treating Prior to Receiving a Test Result

Health care providers should strongly consider treating prior to test results if clinical history is strongly suggestive of pertussis, if a person is high risk for severe or complicated disease, or if a person has contact with someone at high risk for severe disease. High-risk groups include infants, pregnant persons in their third trimester, and persons at high risk for severe or complicated disease. Conditions that may put someone at high risk for severe or complicated disease include, but are not limited to, pregnancy, immunocompromising conditions, moderate to severe medically treated asthma, and infants less than 1 year old. In these cases, specimen should be collected prior to treatment and treatment should begin prior to receiving laboratory results.

Managing Symptoms at Home

After receiving antibiotics most people can manage the illness at home. Patients may find it helpful to keep their living space free from things that can cause coughing (e.g., smoke, dust, chemical fumes), use a clean, cool mist humidifier to loosen mucus and soothe the cough, eat small meals every few hours to help prevent vomiting, and get plenty of fluids, including water, juices, and fruits.

Patients should not take cough medicine unless recommended by their health care provider. Cough medicine is unlikely to help and is not usually recommended for children younger than 4 years old.

Hospitalization

Pertussis can be very serious and can cause complications, especially for infants. People with serious illness or complications may require hospital admission. Treatment of pertussis at a hospital will typically focus on keeping airways clear, monitoring breathing, and giving supplemental oxygen if needed, and preventing or treating dehydration via administration of intravenous fluids.

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Summary Table

Table 1: Pertussis laboratory testing, who to treat, and potential symptoms by week of cough illness

| | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Weeks 7-9 | Weeks 10-12+ |
|----------------------------------|--|---|---|---|---|---|---|--|
| Optimally timed laboratory tests | PCR, Culture | PCR, Culture | PCR, Serology | PCR, Serology | Serology | Serology | Serology reliably until week 8, and with less reliability until week 12 | Serology with less reliability |
| Who to treat | All | All | All | Infants <1 year and pregnant persons | Infants <1 year and pregnant persons | Infants <1 year and pregnant persons | Treatment is not recommended | Treatment is not recommended |
| Potential symptoms | Runny nose, low-grade fever, mild occasional cough | Runny nose, low-grade fever, mild occasional cough OR Coughing fits (paroxysms), “whoop” sound upon inhale after cough, post-tussive vomiting, exhaustion after coughing fits | Coughing fits (paroxysms), “whoop” sound upon inhale after cough, post-tussive vomiting, exhaustion after coughing fits | Similar to week 3 OR May begin to see improvement in symptoms | Similar to week 4 OR May begin to see improvement in symptoms | Similar to week 5 OR May begin to see improvement in symptoms | Similar to week 6 until week 10 OR May begin to see improvement in symptoms | Recovery period, less coughing, may still have coughing fits, slowly starting to feel better |

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References and Resources

National References

- American Academy of Pediatrics. [Pertussis (Whooping Cough).] In: Kimberlin DW, Banerjee R, Barnett ED, Lynfield R, Sawyer MH, eds. *Red Book: 2024 Report of the Committee on Infectious Diseases*. American Academy of Pediatrics; 2024:[656-667]
- Centers for Disease Control and Prevention. *Manual for the Surveillance of Vaccine-Preventable Diseases*. Chapter 10: Pertussis. Atlanta, GA: Centers for Disease Control and Prevention, Last Reviewed: May 2020. <https://www.cdc.gov/surv-manual/php/table-of-contents/chapter-10-pertussis.html>
- U.S. Centers for Disease Control and Prevention (U.S. CDC), Pertussis:
<https://www.cdc.gov/pertussis/hcp/clinical-overview/>
 - Antimicrobial Agents for Treatment and Post-Exposure Prophylaxis, MMWR 2005: <https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5414a1.htm>
 - Treatment of Pertussis: <https://www.cdc.gov/pertussis/hcp/clinical-care/index.html>
 - Testing for Pertussis: <https://www.cdc.gov/pertussis/php/laboratories/index.html>
 - Pertussis: Summary of Vaccine Recommendations: <https://www.cdc.gov/pertussis/hcp/vaccine-recommendations>

Maine-Specific Resources

- HETL, Information on Submitting: <https://www.maine.gov/dhhs/mecdc/public-health-systems/health-and-environmental-testing/micro/submitting-samples.shtml>
- Maine CDC, Pertussis: www.maine.gov/dhhs/pertussis
- Maine Immunization Program www.immunizeme.org
- Maine School Immunization Requirements: https://www.maine.gov/doe/sites/maine.gov.doe/files/inline-files/Immunization%20Requirements%20for%20Schools.2_2023.pdf
- Maine's Notifiable Conditions List and Reporting Form: <http://www.maine.gov/dhhs/mecdc/infectious-disease/epi/disease-reporting/>

Other References

Cole M, Simon AK, Faulkner A, Skoff T, Tondella ML, Montero C, Nye MB, Williams M. 2024. Comparison of Bordetella species identification among differing rt-PCR assays in the United States. *Microbiology Spectrum* Spectr12:e00783-24. <https://doi.org/10.1128/spectrum.00783-24>