

Pertussis Outbreak Control Guidelines

Infectious agent

Bacteria: *Bordetella pertussis* (B. pertussis)

Clinical manifestations

Pertussis is an acute infection of the respiratory tract. The clinical course of the illness is divided into three stages:

Catarrhal phase

- Characterized by insidious onset of mild upper respiratory symptoms including low- grade fever, coryza (runny nose), sneezing, and a mild, occasional cough.
- During the 1 – 2 weeks of this stage, the cough gradually becomes more severe.

Paroxysmal phase

- Characterized by spasmodic coughing episodes, or paroxysms, sometimes followed by a long inspiratory whooping sound. Paroxysmal attacks occur more frequently at night.
- Patients may become cyanotic during paroxysms.
- Children and young infants may appear very ill and distressed.
- Post-tussive vomiting and exhaustion commonly follow the episode.
- The person does not appear ill between attacks.
- This stage usually lasts 1 – 6 weeks but may persist for up to 10 weeks.

Convalescent phase

- Recovery is gradual.
- Paroxysms subside and the cough may disappear in 2 – 3 weeks.
- Paroxysmal episodes may return with other respiratory infections.
- This stage can persist for weeks to months.

Catarrhal	Paroxysmal	Convalescent
1 – 2 weeks	1 – 6 weeks	Weeks – Months

Clinical Considerations by age group

Infants:

- Pertussis in infants < 6 months old may present with atypical symptoms which include:
 - Short catarrhal stage,
 - Gagging, gasping or apnea in early stages,
 - Absence of whoop, AND
 - Prolonged convalescence.
- Pertussis is more severe in the first year of life and in premature infants.
 - Sudden unexpected death can be caused by pertussis.

Adolescents and Adults:

- Older adolescents and adults may have milder symptoms particularly if previously immunized.
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Complications

The most common complication, and the cause of most pertussis-related deaths, is secondary bacterial pneumonia. Young infants are at the highest risk for acquiring pertussis-associated complications.

Complications by age group

Infants

- Pneumonia
- Seizures
- Encephalopathy
- Death

Adolescents and adults

- Syncope
- Sleep disturbance
- Incontinence
- Rib fractures
- Pneumonia

Other complications

- Weight loss
- Dehydration
- Anorexia
- Otitis media

Complications resulting from the pressure effects of severe paroxysms include subdural hematomas, epistaxis, hernia, incontinence, rectal prolapse and pneumothorax.

Incubation period

- 4 – 21 days (average 7 – 10 days).
- Rarely may be as long as 42 days.

Period of communicability

- Pertussis is highly communicable, with a secondary attack rate of 80% among susceptible household contacts.
- First Day of Communicability = date of catarrhal symptom onset.
- Last Day of Communicability = 21 days after onset of paroxysms, or 5 days after initiation of appropriate antibiotic therapy.
- Period of Communicability = first day through last day of communicability.

Transmission

- Commonly occurs by the respiratory route through contact with respiratory droplets, OR
- By direct contact with airborne droplets of respiratory secretions.
- Occurs less frequently by contact with freshly contaminated articles of an infected person.

Basic epidemiology

- Pertussis is a human disease and occurs worldwide.
- Adolescents and adults are an important reservoir and are often the source of pertussis in children and infants.
- There is no distinct seasonal pattern, but it may increase in the summer and fall.
- Pertussis occurs endemically with 3 – 5 year cycles of increased disease.
- Neither infection nor immunization confers lifelong immunity. Partially immune individuals may have infection with mild symptoms.
- Increased awareness, improved diagnostic tests, better reporting, more circulation of the bacteria and waning immunity are responsible for the growing number of cases of pertussis.
 - In 2012, the incidence rate of pertussis among infants exceeded that of all other age groups.
 - The second highest rate of disease is observed among children 7 – 10 years old.
 - Rates are also increased in adolescents 13 and 14 years of age.

Case definition

Case definition and classifications approved by CSTE 2020

Clinical criteria: In the absence of a more likely diagnosis, a cough illness lasting ≥ 2 weeks, with at least one of the following signs or symptoms:

- Paroxysms of coughing; OR
- Inspiratory whoop; OR
- Post-tussive vomiting; OR
- Apnea (with or without cyanosis).

Laboratory criteria for diagnosis:

- Isolation of *B. pertussis* from a clinical specimen, OR
- Positive polymerase chain reaction (PCR) assay for *B. pertussis* DNA.
- Additional NYS comments:
 - Culture is considered the gold standard of laboratory tests and is the most specific lab test for pertussis.
 - PCR is less specific than culture but has increased sensitivity.
 - CDC and NYSDOH strongly recommend that one or more cases be confirmed to be pertussis by positive culture results.
 - Negative tests are not sufficient to rule out pertussis.
 - PCR test must be performed at a NYS-approved laboratory.
 - Serologic testing is not standardized and should not be relied on as criterion for lab confirmation.

Epidemiologic Linkage

Contact with a laboratory-confirmed case of pertussis*

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Case Classification

Probable case

In the absence of a more likely diagnosis, illness meeting the clinical criteria

OR

A cough illness lasting any duration, with

- at least one of the following signs or symptoms:
 - Paroxysms of coughing; OR
 - Inspiratory “whoop”; OR
 - Post-tussive vomiting; OR
 - Apnea (with or without cyanosis)

AND

- Contact with a laboratory confirmed case (epidemiologic linkage)

Confirmed case

Acute cough illness of any duration, with

- isolation of *B. pertussis* from a clinical specimen **OR**
- PCR positive for *B. pertussis*

Outbreak and Cluster Definition

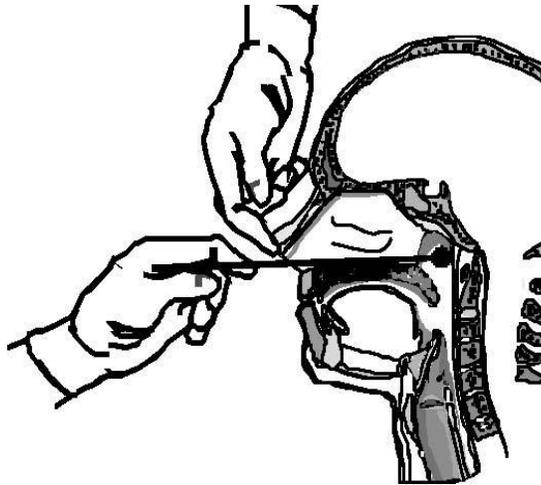
- Two or more cases have occurred within 42 days of each other and clustered in a common setting.
 - For reporting, the cluster category is accepted nationally as cases exclusive to a “household”.

Testing and diagnosis

The diagnosis of pertussis is based on a characteristic clinical history as well as positive culture or PCR results. These tests are more reliable when performed early in the course of the illness. All specimens should be nasopharyngeal specimens, NOT pharyngeal (throat). Testing of asymptomatic contacts is NOT necessary and should be discouraged.

Specimen collection

- Nasopharyngeal (NP) swab
 - Use Dacron, rayon or nylon-flocked swab (not cotton or calcium alginate). Insert slowly through the nostril to the posterior pharynx.
 - To avoid specimen cross-contamination, the use of gloves and good hand washing technique are recommended.
 - Ideally the swab is left in the posterior pharynx for 10 seconds before withdrawing.
 - Separate specimens may be required by some laboratories if both culture and PCR are ordered
 - ◆ A swab used for PCR only (not culture) may be placed in a sterile tube for transport.
 - ◆ A swab used for culture (or a swab used for both culture and PCR) must be placed in an appropriate transport medium such as Regan-Lowe transport medium.
 - ◆ The use of liquid transport medium is discouraged.



- Nasopharyngeal aspirate
 - Obtain by inserting a small tube (e.g. infant feeding tube) connected to a mucous trap into the nostril back to the posterior pharynx.
 - Secretions are aspirated while tube is in position and while partly withdrawing tube.
 - Material in the mucous trap and material flushed from the tube are used to inoculate the culture medium.
 - The specimen may be split at the time of collection for (PCR) testing.

Diagnostic Tests

Bacterial culture

- Considered to be the “gold standard” laboratory test. It is the most specific but not highly sensitive.
- Obtained by nasopharyngeal aspiration or NP swab.
- Prior antibiotic therapy may interfere with growth.
- Specimens obtained for culture within 1 – 2 weeks of the onset of cough have higher proportion of culture positive results.

PCR

- Provides increased sensitivity and faster reporting results.
 - False positive test results have been identified from specimen contamination at the point of collection.
 - Causes of false positives include clinic contamination with pertussis DNA from vaccine and/or from true cases.
 - Laboratory test results should be used in conjunction with clinical symptoms for diagnosis.
- Should be used to confirm the diagnosis of pertussis only when the case also satisfies the clinical case definition.
- PCR is less affected by prior antibiotic therapy.
- NYS provides an approved list of laboratories that perform PCR testing for confirmation of pertussis.
 - The list is updated as needed and is distributed through the NYSDOH regional offices.
 - Wadsworth Center can assist with testing, especially in an outbreak setting.
 - Contact the NYSDOH Bureau of Immunization at (518) 473-4437 for more information.

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NOTE: Serology assays are not considered reliable at this time. DFA tests are no longer recommended by the NYSDOH or CDC. The Massachusetts (MA) Department of Public Health provides the only reliable diagnostic serologic test in the U.S. A positive serology result from the MA state lab to confirm pertussis is acceptable for children over the age of 11 and adults.

PCR and Culture Collection kits

- Individual labs should be contacted by the provider to obtain the proper kits and instructions for obtaining the necessary specimen, OR
- Contact Wadsworth Center Order Desk at (518) 474-4175 for collection/transport kit DOH-1986.
 - Quantities are limited.
 - Contact the NYSDOH Bureau of Immunization at (518) 473-4437 for more information.
- Carefully complete the history form, including the clinical information.
- Label the specimen tube or slide with the patient's name.
- Unlabeled specimens will not be tested.
- Use the nasopharyngeal swab provided in the kit and avoid mixing with other kits.

Specimen source

- Nasopharyngeal swab

Procedure for Wadsworth Center specimen

- PCR and culture
 - Inoculate the holding medium in the screw-capped tube by gently rubbing the swab over the surface of the media.
 - Leave swab in the tube.
 - Clip and discard excess wire and replace the cap.
 - Label the tube with the patient's name.
- Transport
 - Place history and instructions on the outside of the specimen transport bag.
 - Place the specimen transport bag into the outer shipping container.
 - Keep refrigerated until shipping.
 - Send overnight delivery when possible.
 - Avoid shipping on Friday unless special arrangements are made with Wadsworth Center to receive the specimen.

Overnight delivery should be mailed to:

*Bacteriology
David Axelrod Institute
Wadsworth Center, NYSDOH
120 New Scotland Avenue
Albany, NY 12208*

Questions: Call Wadsworth Center at (518) 474-4177

Case investigation

Demographics

- Name
- Address
- DOB/age
- Occupation/Setting
- Race
- Ethnicity
- Gender
- Date Reported

Reporting Source

- Date reported
- Source
- Provider
- County

Clinical information

- Date of cough onset
- Symptoms
- Predisposing factors related to increased severity (e.g., prematurity, immunosuppression, pregnant)

Laboratory results

- Lab name
- Date of specimen
- Type of tests
- Results/confirmation

Treatment

- Antibiotics
- Start date
- Duration of treatment

Epidemiology

- Date investigation started
- Transmission setting
- Travel
- Contact with known case
- Outbreak related
- Known or possible sources of exposure of the case
- Create line listing if a total of 3 or more probable, suspect or confirmed cases

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Vaccine history

- Type
- Manufacturer
- Number of doses
- Vaccination dates
- Lot number
- Document adolescent and adult Tdap vaccine histories
- Reason if not vaccinated

Outcome

- Complications
- X-ray results for pneumonia
- Hospitalization and duration
- Date of death

Control measures

- An antibiotic effective against pertussis (see below) should be administered to the patient, as indicated, regardless of age and vaccination status. Early treatment reduces transmission and is essential for disease control.
- The primary objective of postexposure antimicrobial prophylaxis (PEP) should be to prevent death and serious complications from pertussis in individuals at increased risk of severe disease.
- With increasing incidence and widespread community transmission of pertussis, extensive contact tracing and broad scale use of PEP among contacts may not be an effective use of limited public health resources. While antibiotics may prevent pertussis disease 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.
- Another important consideration is the overuse of antibiotics; CDC is engaged in actively promoting the judicious use of antibiotics among healthcare providers and parents. Given these considerations, CDC and NYS supports **targeting PEP to persons at high risk of developing severe pertussis and to persons who will have close contact with those at high risk of developing severe pertussis.**
- When pertussis is strongly suspected, attempts to identify and provide PEP to household and close contacts at high risk should proceed without waiting for lab confirmation. When suspicion of pertussis is low, the investigation can be delayed until there is lab confirmation of diagnosis.

Antibiotics for pertussis treatment and prophylaxis

Azithromycin (Zithromax)

- 10 mg/kg/day in one daily dose
- Maximum daily dose = 500 mg
- Duration: 5 days

Clarithromycin (Biaxin)

- 15-20 mg/kg/day divided into two daily doses
- Maximum daily dose = 1 g
- Duration: 7 days

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Erythromycin

- 50 mg/kg/day divided into four daily doses
- Maximum daily dose = 2 g
- Duration: 14 days

Trimethoprim (TMP)-sulfamethoxazole (Bactrim, Septra)

- 8 – 10 mg (TMP component)/kg/day divided into two daily doses
- Maximum daily dose = 320 mg
- Duration: 14 days
 - NOT recommended for infants < 2 months of age, pregnant women at term, or nursing mothers
 - Alternative for patients who cannot tolerate macrolides
 - Used against macrolide resistant strains

TABLE 4. Recommended antimicrobial treatment and postexposure prophylaxis for pertussis, by age group

Age group	Primary agents			Alternate agent*
	Azithromycin	Erythromycin	Clarithromycin	TMP-SMZ
<1 month	Recommended agent. 10 mg/kg per day in a single dose for 5 days (only limited safety data available.)	Not preferred. Erythromycin is associated with infantile hypertrophic pyloric stenosis. Use if azithromycin is unavailable; 40–50 mg/kg per day in 4 divided doses for 14 days	Not recommended (safety data unavailable)	Contraindicated for infants aged <2 months (risk for kernicterus)
1–5 months	10 mg/kg per day in a single dose for 5 days	40–50 mg/kg per day in 4 divided doses for 14 days	15 mg/kg per day in 2 divided doses for 7 days	Contraindicated at age <2 months. For infants aged ≥2 months, TMP 8 mg/kg per day, SMZ 40 mg/kg per day in 2 divided doses for 14 days
Infants (aged ≥6 months) and children	10 mg/kg in a single dose on day 1 then 5 mg/kg per day (maximum: 500 mg) on days 2–5	40–50 mg/kg per day (maximum: 2 g per day) in 4 divided doses for 14 days	15 mg/kg per day in 2 divided doses (maximum: 1 g per day) for 7 days	TMP 8 mg/kg per day, SMZ 40 mg/kg per day in 2 divided doses for 14 days
Adults	500 mg in a single dose on day 1 then 250 mg per day on days 2–5	2 g per day in 4 divided doses for 14 days	1 g per day in 2 divided doses for 7 days	TMP 320 mg per day, SMZ 1,600 mg per day in 2 divided doses for 14 days

* Trimethoprim sulfamethoxazole (TMP–SMZ) can be used as an alternative agent to macrolides in patients aged ≥2 months who are allergic to macrolides, who cannot tolerate macrolides, or who are infected with a rare macrolide-resistant strain of *Bordetella pertussis*.

Source: MMWR, Recommendations and Reports, December 9, 2005

Exclusion

- Symptomatic persons should be excluded from work or school until completion of the first 5 days of a full course of antimicrobial treatment.
- Symptomatic persons who do not take antimicrobial treatment should be excluded for 21 days from the onset of cough.
- Under-immunized and unimmunized children attending daycare should be excluded immediately until they have met immunization requirements for admission.
- Healthcare provider (HCP) with symptoms of pertussis should be excluded from work until completion of at least the first 5 days of a full course of antimicrobial treatment.

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- HCP with symptoms of pertussis who cannot or refuses to take antimicrobial therapy should be excluded from work for 21 days from onset of cough. The use of a respiratory mask is not sufficient protection.

Contact definitions

Close Contact

- Direct face-to-face exposure within three feet of a symptomatic patient (e.g. close friends, playmates, household members, girlfriend, boyfriend, teammates, healthcare provider, patients).
- Direct contact with respiratory, oral, nasal, or pharyngeal secretions from a symptomatic case-patient (e.g., kissing; sharing lip gloss, cigarettes, drugs, food, utensils).

High-Risk Contacts

- Include persons for whom the risk of severe disease or poor outcome may be higher and in those to whom these groups may transmit disease. The description of these groups is included in the recommendations below.
 - **All household contacts of a pertussis case.** Within families, secondary attack rates have been demonstrated to be high, even when household contacts are current with immunizations. As a best practice, administration of antimicrobial prophylaxis to asymptomatic household contacts within 21 days of onset of cough in the index patient can prevent symptomatic infection. Providing PEP within 21 days of exposure can be considered for high-risk family members.
 - **Provide PEP to persons within 21 days of exposure to an infectious pertussis case patient who are at high risk of severe illness or who will have close contact with a person at high risk of severe illness.** These include:
 - **Infants and women in their third trimester of pregnancy** — severe and sometimes fatal pertussis-related complications occur in infants aged <12 months, especially among infants aged <4 months. Women in their third trimester of pregnancy may be a source of pertussis to their newborn infant.
 - **All persons with pre-existing health conditions that may be exacerbated by a pertussis infection** (for example, but not limited to immunocompromised persons and patients with moderate to severe medically treated asthma).
 - **Contacts who themselves have close contact with either infants under 12 months, pregnant women or individuals with pre-existing health conditions at risk of severe illness or complications.**
 - **All contacts in high risk settings that include infants aged <12 months or women in the third trimester of pregnancy.** These include, but are not limited to neonatal intensive care units, childcare settings, and maternity wards.
 - A broader use of PEP in limited closed settings may be considered when the number of identified cases is small and when a community-wide outbreak is not ongoing. (Example: prison or jail)
 - When continued transmission of pertussis is evident, multiple rounds of antibiotics would not be recommended. Rather than repeating a course of antibiotics, contacts should be monitored for onset of signs and symptoms of pertussis for 21 days.

Management of contacts

Household and high risk contacts of confirmed or probable case

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- Should receive appropriate chemoprophylaxis irrespective of immunization status.
- Should be observed for respiratory symptoms for 21 days after last exposure.
- Generally, do not need prophylaxis if last exposure was > 21 days after the onset of case symptoms.

Healthcare Personnel

- Those who have appropriately followed standard and droplet precautions during close contact with cases do not require prophylaxis.
- HCP previously vaccinated with Tdap:
 - Health care facilities should continue to provide post-exposure prophylaxis for vaccinated HCP who have unprotected exposure to pertussis and are likely to expose patients at risk for severe pertussis.
 - Providing repeat prophylaxis is not generally recommended but may be considered for HCP who have close contact with hospitalized neonates and pregnant women. Otherwise, HCP who have been exposed again should proceed with the "watchful waiting" approach and if a cough illness develops be tested and treated at that time.

Contacts at high risk of severe disease

- These contacts may benefit from antibiotic prophylaxis even if exposure occurred up to 42 days from the case's onset of cough.

Symptomatic contacts of a confirmed or probable case

- Refer for medical evaluation.
- Begin treatment/prophylaxis as appropriate for patient.
- Obtain appropriate diagnostic specimens prior to treatment or prophylaxis, if this will not compromise medical care.
- Follow-up on diagnostic test results.
- Begin case investigation.

Immunization of Contacts

At this time, providing vaccine for outbreak control, or to increase the level of immunity within a community during an outbreak, has not been recognized as a control measure. A case provides the opportunity to review the vaccine status of individuals exposed to pertussis and recommend age appropriate vaccination with pertussis-containing vaccine.

Review immunization status

- Contacts under 7 years old:
 - Infants may be immunized as early as six weeks of age.
 - Close contacts who are unimmunized or under-immunized should receive age appropriate vaccination.
 - Children who received their 3rd dose 6 or more months ago should receive a 4th dose of diphtheria and tetanus toxoids and acellular pertussis (DTaP).
 - Children who received their 4th dose 3 or more years before exposure should be given a 5th dose of DTaP vaccine.
- Contacts who are over the age of 7 years:
 - A single dose of Tdap vaccine is recommended by ACIP for children aged 7 through 10 years who are not fully vaccinated against pertussis.

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- A single dose of Tdap should be administered to contacts 10 years or older (Boostrix licensed for persons 10 to 18 years of age; Adacel licensed for persons 11 to 64 years of age). These vaccines are only licensed for a single lifetime dose.
- Tetanus and diphtheria antigens are generally given every 10 years. Tdap can be administered regardless of interval since the last Td.
- ACIP recommends adults age 65 years and older receive a single dose of Tdap to replace the decennial dose of Td.
- ACIP recommends the use of Tdap during every pregnancy.
 - Optimal timing for Tdap administration is between 27 and 36 weeks gestation, although Tdap may be given at any time during pregnancy.
 - If not administered during pregnancy, Tdap should be administered immediately postpartum.

Reporting

A Confidential Case Report Form (DOH-389) must be submitted.

LHDs must be notified within 24 hours of when a case is suspected or identified. Parapertussis is not nationally notifiable.

Additional clinical information

- *B. parapertussis*
 - *B. parapertussis* causes a milder disease but is clinically indistinguishable from illness caused by *B. pertussis*. As for disease caused by *B. pertussis*, infants may have more severe disease and should be protected.
 - Pertussis containing vaccines do not protect against parapertussis. There is little evidence supporting cross protection between pertussis and parapertussis. Co-infection with both pertussis and parapertussis is possible.
 - There are no official recommendations/guidelines on case management of parapertussis. Based on limited data, the CDC recommends that confirmed cases of parapertussis be treated to impact disease severity, especially in infants.
 - Prophylactic treatment of household contacts should be strongly considered if there is an infant under the age of 6 months in the household. All infants under 6 months of age should receive antibiotic prophylaxis if they have been in contact with a person who has parapertussis.
 - Limited clinical data on antibiotics suggest parapertussis is susceptible to both erythromycin and TMP-SMX. However, if the patient has been previously treated with Clarithromycin or Azithromycin, it is not necessary to repeat treatment. The dosing schedule is the same as for pertussis.
 - Symptomatic contacts should be treated but do not need to be excluded.
 - Parapertussis does not need to be investigated or reported.