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Pertussis

Surveillance and Investigation Protocol

Table of Contents

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I. ABOUT THE DISEASE

Pertussis, also known as whooping cough, is a highly contagious respiratory disease caused by the bacterium *Bordetella pertussis (B. pertussis).* Pertussis is known for uncontrollable, violent coughing which often makes it hard to breathe. After fits of coughing, someone with pertussis often needs to take deep breaths which results in a "whooping" sound. Pertussis can affect people of all ages, but can be very serious, even deadly, for babies less than a year old.

Individual cases of pertussis (suspected and confirmed) are to be reported to the local health department (LHD) within 24 hours; however, outbreaks of pertussis should be reported immediately.

A. Clinical Presentation

Whooping cough usually starts with mild respiratory symptoms that are similar to the common cold, such as runny nose, sneezing, fever, and a mild cough. These symptoms can last up to two weeks and are followed by increasingly severe coughing spells. If a fever is present, it is usually mild. The clinical course is divided into three stages:

Catarrhal Stage: Characterized by a gradual onset of coryza (runny nose), sneezing, low grade fever, and a mild, occasional cough, similar to the common cold. The cough gradually becomes more severe, and after 1-2 weeks, the second or paroxysmal stage begins. Patients with pertussis are most infectious from the beginning of the catarrhal stage through the third week after onset of paroxysms.

Paroxysmal Stage: Characterized by bursts, or paroxysms of numerous, rapid coughs, due to difficulty expelling thick mucus from tracheobronchial tree. At the end of the paroxysm, a long inspiratory effort is usually accompanied by a characteristic high-pitched whoop. During such an attack, the patient may become cyanotic (turn blue). Vomiting and exhaustion commonly follow the episode. The patient usually appears normal between attacks. Paroxysms can occur more frequently at night.

Convalescent Stage: Characterized by gradual recovery. Paroxysmal coughing lessens and disappears over 2-3 weeks. However, paroxysms often recur with subsequent viral respiratory infections for many months after the onset of pertussis.

Adolescents, adults, and those partially protected by the vaccine usually have milder disease. Pertussis in these people may present as a persistent cough and may be indistinguishable from other upper respiratory infections. Those who are infected with milder symptoms can still transmit the disease to others who are susceptible, including infants, who haven't been fully immunized.

B. Etiologic Agent

Bordetella pertussis is a fastidious, gram-negative, pleomorphic bacillus.

C. Reservoir
Humans are the only known hosts of *B. pertussis*. Adolescents and adults are an important reservoir for *B. pertussis* and are often the source of infection for infants and young children.

D. Incubation Period
The average incubation period is 7 to 10 days, with a range of 5 to 21 days.

E. Mode of Transmission
Transmission most commonly occurs through contact with respiratory droplets or by contact with airborne droplets from respiratory secretions. Transmission occurs less frequently by contact with freshly contaminated surfaces from an infected person. Cases occur year-round, typically with a late summer-autumn peak.

F. Period of Communicability
Pertussis is highly communicable with a secondary attack rate of 80% among susceptible household contacts. Persons with pertussis are most infectious during the catarrhal period and the first two weeks after cough onset (i.e., approximately the first 21 days). Antibiotic treatment initiated during the paroxysmal stage will not alter the course of illness; however, it will limit the spread of the organism.

II. DISEASE CONTROL AND PREVENTION

A. Disease Control Objectives
Prevent additional/secondary case(s) by:

1. Placing confirmed and probable cases in droplet isolation to inhibit further spread of pertussis.
2. Early identification of close contacts and providing post-exposure prophylaxis (PEP) and vaccination as indicated.

B. Disease Prevention Objectives
1. Prevent cases of pertussis by encouraging pertussis vaccination. Please see CDC's Pertussis: Summary of Vaccine Recommendations for additional information.

C. Disease Prevention and Control Intervention
Prevention

1. The best way to prevent pertussis is to get vaccinated. There are two kinds of vaccines used in the United States today to help protect against pertussis, both of which also provide protection against other diseases:

a. Diphtheria, tetanus, and pertussis (DTaP) vaccines – for infants and children younger than seven years old,
b. Tetanus, diphtheria, and pertussis (Tdap) vaccines – for children older than seven years of age and adults.
c. Pregnant women should have one dose of Tdap during the 3rd trimester of **each** pregnancy, which will provide protection to the infant until they are old enough to be vaccinated.

For a complete summary of pertussis vaccination recommendations, please visit CDC's Pertussis: Summary of Vaccine Recommendations.

2. Educate the public regarding the potential severity of pertussis, transmission, prevention, risks, and when vaccination is recommended.
3. Educate the public about proper cough etiquette and respiratory hygiene. Emphasize why they are important for pertussis and other diseases that are spread by respiratory droplets.
4. Washing hands helps stop the spread of infection; therefore, continue to educate about proper hand hygiene and washing hands frequently.

Control

1. Place confirmed and probable cases in droplet isolation to inhibit further spread of pertussis.
    a. Droplet isolation should be in place for five days after starting antimicrobial therapy or 21 days after the onset of cough if the patient does not receive the recommended antimicrobial therapy.
    b. Information on droplet precautions can be found at: www.cdc.gov/infectioncontrol/basics/transmission-based-precautions.html.
2. Recommend PEP to all households and other close contacts of a probable or confirmed case, regardless of their immunization status. PEP has limited value if 21 days have passed since exposure but is a consideration for high-risk contacts. See treatment section regarding recommended PEP.
    a. Close contacts are defined as a person(s) that had:
        i. Face-to-face exposure within three feet of a symptomatic patient; or
        ii. Direct contact with respiratory, nasal, or oral sections of a symptomatic patient; or
        iii. Shared confined space in close proximity for one hour or more.
3. Close contacts should be monitored for respiratory symptoms for 21 days after last contact with the infected person and evaluated if a cough develops.
4. Close contacts who are unimmunized, underimmunized, or if their immunization status is not known, should receive age-appropriate pertussis vaccines as soon as possible. Please see CDC's Pertussis: Summary of Vaccine Recommendations for additional information.

D. Treatment

Early treatment of pertussis is most effective for reducing symptom severity. The earlier a person, especially an infant, starts treatment the better. If a person starts treatment during the first 1 to 2 weeks before coughing paroxysms occur, symptoms may be lessened, and the risk of transmission reduced. Antibiotics will not alter the course of the illness or prevent transmission if they are given later in the course of illness, usually after the onset of paroxysms.

Clinicians should strongly consider treating prior to test results if any of the following are present:

- Clinical history is strongly suggestive of pertussis,
- The person is at risk for severe or complicated disease (e.g., infants),
- The person has or will soon have routine contact with someone that is considered at high risk of serious disease (e.g., pregnant women).

A reasonable guideline is to treat:

- Children one year of age and older within three weeks of cough onset,
- Infants younger than one year of age and pregnant women (especially if they are near term) within six weeks of cough onset.

The treatment for pertussis and the PEP are the same; therefore, the same microbial treatment should be initiated for contacts and cases. PEP should be given to contacts who are within three weeks of exposure.

The recommended antimicrobial agents for treatment or chemoprophylaxis of pertussis are:

- Azithromycin,
- Clarithromycin,
- Erythromycin,
- Clinicians can also use Trimethoprim-sulfamethoxazole.

Clinicians should choose the antimicrobial after consideration of the:

- Potential for adverse events and drug interactions,
- Tolerability,
- Ease of adherence to the regimen prescribed,
- Cost.

Treatment options vary by age:

- Macrolides erythromycin, clarithromycin, and azithromycin are preferred for the treatment of pertussis in children one month of age and older.
- For children two months of age and older, an alternative to macrolides is trimethoprim-sulfamethoxazole.
- For infants younger than one month of age, use macrolides with caution as an association between orally administered erythromycin and azithromycin with infantile hypertrophic pyloric stenosis (IHPS) has been reported. However, azithromycin remains the drug of choice for treatment or prophylaxis of pertussis in very young infants because the risk of developing severe pertussis and life-threatening complications outweighs the potential risk of IHPS. Clinicians should monitor infants younger than one month of age who receive a macrolide for the development of IHPS and for other serious adverse events.

Recommended Antimicrobial Therapy and Postexposure Prophylaxis for Pertussis in Infants, Children, Adolescents, and Adults

Age	Recommended Drugs			Alternative
	Azithromycin[1,2]	Erythromycin	Clarithromycin[1]	TMP-SMX[3,4]
< 1 month	10 mg/kg/day as a single dose daily for 5 days	40 mg/kg/day in 4 divided doses for 14 days	Not recommended	Contraindicated at younger than 2 months of age
1–5 months	10 mg/kg/day as a single dose daily for 5 days	40 mg/kg/day in 4 divided doses for 14 days	15 mg/kg/day in 2 divided doses for 7 days	≥ 2 mo of age: TMP, 8 mg/kg/day; SMX, 40 mg/kg/day in 2 divided doses for 14 days
≥ 6 months and children	10 mg/kg as a single dose on day 1 (maximum 500 mg), then 5 mg/kg/day as a single dose on days 2–5 (maximum 250 mg/day)	40 mg/kg/day in 4 divided doses for 7–14 days (maximum 1–2 g/day)	15 mg/kg/day in 2 divided doses for 7 days (maximum 1 g/day)	≥ 2 mo of age: TMP, 8 mg/kg/day; SMX, 40 mg/kg/day in 2 divided 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 2–5	2 g/day in 4 divided doses for 7–14 days	1 g/day in 2 divided doses for 7 days	TMP, 320 mg/day; SMX, 1600 mg/day in 2 divided doses for 14 days

[1] Azithromycin and clarithromycin are not approved by the Food and Drug Administration (FDA) for infants younger than six-months. An association between azithromycin and clarithromycin with idiopathic hypertrophic pyloric stenosis (IHPS) has been reported in infants younger than one month. Although, the drug of choice for infants younger than one month is azithromycin because the risks of pertussis outweigh the risks of IHPS.

[2] Azithromycin should be used with caution in patients with prolonged QT interval and certain proarrhythmic conditions.
[3] TMP indicates trimethoprim; SMX indicates sulfamethoxazole.
[4] TMP-SMX is classified as a pregnancy category D, and therefore should be avoided during pregnancy.

III. DISEASE INVESTIGATION

A. Criteria for Case Ascertainment

Clinical Criteria for Reporting:

- An acute cough illness of any duration with inspiratory whoop or paroxysmal cough or post-tussive vomiting or apnea.

Laboratory Criteria for Reporting:

- Any person with isolation of *B. pertussis* from a clinical specimen or a positive PCR test for pertussis.

Epidemiologic Linkage Criteria for Reporting:

- An acute cough illness of any duration in a person who is a contact of a laboratory-confirmed pertussis case.
- An acute cough illness of any duration in a person who is a member of a defined risk group during an outbreak.

Vital Records Criteria for Reporting:

- A person whose death certificate lists pertussis as a cause of death or a significant condition contributing to death.

Other Criteria for Reporting:

- A person whose healthcare record contains a diagnosis of pertussis.

B. Case Definition and Case Classification

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

Confirmatory laboratory evidence:

- Isolation of *B. pertussis* from a clinical specimen.
- Positive Polymerase Chain Reaction (PCR) for *B. pertussis*.

Epidemiologic Linkage

- Contact with a laboratory-confirmed case of pertussis.

Case Classification

Probable

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

  OR

- Illness with cough of 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

- Acute cough illness of any duration, with:
  - Isolation of *B. pertussis* from a clinical specimen OR,
  - PCR positive for *B. pertussis*.

C. Reporting Timeframe to Public Health

Pertussis is reportable within 24 hours to the LHD in the county where the patient resides. An outbreak or suspected outbreak of pertussis is reportable immediately to the LHD in the county where the patient resides.

D. Outbreak Recognition

An outbreak of pertussis is defined as two or more epi-linked cases from different households with symptom onset within 42 days of one another.

E. Healthcare Provider Responsibilities

1. Manage patients with pertussis and their close contacts in accordance with physician's guideline available at: oeps.wv.gov/pertussis/documents/hcp/Pertussis_Physician_FAQ.pdf .
2. Educate the patient about pertussis transmission, prevention, and treatment.
3. Report any suspected or confirmed cases of pertussis to the LHD within 24 hours of diagnosis.
    a. Complete the provider section of West Virginia Electronic Disease Surveillance System (WVEDSS) Pertussis form: oeps.wv.gov/pertussis/documents/lhd/Pertussis.pdf .
    b. Fax the completed form to the patient's LHD and report by phone to the patient's LHD. Timely reporting enables your LHD to follow up on contacts and interrupt the chain of transmission.
4. Obtain laboratory confirmation (nasopharyngeal swab) of suspect cases before starting antibiotics. The organism is most easily recovered from nasopharyngeal mucus in the catarrhal or early paroxysmal stages and is rarely recovered after the fourth week of illness. There are two tests available for pertussis diagnosis: polymerase chain reaction (PCR) and culture. Culture is the gold standard for diagnosis.
5. Testing is available free of charge through the West Virginia Office of Laboratory Services (OLS). For more information about testing through OLS or to consult on laboratory interpretation, please contact the epi on-call at 304-558-5358 ext. 2. Note: Serologic testing is not recommended for surveillance purposes.
6. Submit pertussis specimens (nasopharyngeal swabs or aspirate) to the West Virginia Office of Laboratory Services (OLS) for PCR and culture confirmation (free of charge). PCR alone is associated with high rates of false positive results; therefore, CDC recommends culture whenever PCR is performed.

F. Laboratory Responsibilities

1. Notify provider and infection preventionist of a positive laboratory report of pertussis.
2. Notify LHD of a positive report of pertussis within 24 hours of diagnosis. Report positive test results by phone and send test results via ELR or fax a copy of the laboratory result to the patient's LHD.
3. Submit pertussis specimens (nasopharyngeal swabs or aspirate) to OLS for PCR and culture confirmation (free of charge). PCR alone is associated with high rates of false positive results; therefore, CDC recommends culture whenever PCR is performed. Note: Serologic testing is not recommended for surveillance purposes

G. Local Health Responsibilities

1. Public health investigation of suspected or confirmed pertussis cases should be initiated within 24 hours of receiving the initial report.
2. Report all confirmed and probable cases to the West Virginia Division of Infectious Disease Epidemiology (DIDE) within 24 hours of notification:
    a. All confirmed and probable cases of pertussis should be entered into WVEDSS within 24 hours of notification. Opening a public health investigation in WVEDSS constitutes appropriate reporting of confirmed and probable cases of pertussis.
    b. Copies of paper laboratory results should be entered into WVEDSS if an electronic copy is not already in the system, within 24 hours of receiving the initial report.
3. Prior to investigation of pertussis cases, the LHD should identify employees who will conduct case investigations and/or collect nasopharyngeal specimens. These employees should have documentation of at least one dose of Tdap and receive education on proper use of droplet precautions.
4. Educate the public, healthcare providers, and pregnant women about the importance of vaccination according to the Advisory Committee on Immunization Practices (ACIP) recommendation and about the dangers of pertussis/whooping cough.
5. Educate providers and laboratories to submit pertussis specimens (nasopharyngeal swabs or aspirate) to OLS for PCR and culture confirmation (free of charge). PCR alone is associated with high rates of false positive results; therefore, CDC recommends culture whenever PCR is performed. Note: Serologic testing is not recommended for surveillance purposes.
6. Educate healthcare providers and laboratories to report any suspect cases of pertussis to the LHD within 24 hours.
7. Contact medical provider to collect additional information and confirm diagnosis using the current case definition.
    a. Collect all the information requested.
    b. Ensure that the patient is aware of his/her diagnosis.
8. Conduct case investigation to identify potential source of infection.
9. Conduct contact tracing to locate additional cases and close contacts.
    a. Definition of a close contact:
        i. Anyone who has had direct face-to-face contact for a period (not defined) with a case-patient who is symptomatic during the catarrhal and early paroxysmal stages of infection. This includes ALL residents of the same household; daycare and baby-sitting contacts; and close friends, regardless of immunization status. The disease is spread by direct contact with respiratory secretions or face-to-face exposure.

ii. Shared confined space in close proximity for a prolonged period of time, such as >1 hour, with a symptomatic case-patient, OR
iii. Direct contact with respiratory, oral, or nasal secretions from a symptomatic case-patient (e.g., an explosive cough or sneeze in the face, sharing food, sharing eating utensils during a meal, kissing, mouth-to-mouth resuscitation, or performing a full medical examination including examination of the nose and throat).

b. Management of contacts:
   i. Asymptomatic contacts who are within 3 weeks (21 days) of their last exposure to an infectious case-patient:
      1. Prophylaxis with an approved treatment regimen (See section II. DISEASE CONTROL AND PREVENTION - D. Treatment).
      2. Bring immunizations up to date. Please see CDC's Pertussis: Summary of Vaccine Recommendations.
   ii. Asymptomatic contacts who were last exposed more than 3 weeks (21 days) previously:
      1. Chemoprophylaxis has limited value but should be considered in households that have high risk persons (infants, pregnant women, or persons who have contact with infants).
      2. Bring immunizations up to date. Please see CDC's Pertussis: Summary of Vaccine Recommendations.
   iii. Symptomatic contacts:
      1. Evaluate case status,
      2. Obtain culture and PCR; and then,
      3. Treat with an approved treatment regimen
      4. Bring immunizations up to date. Please see CDC's Pertussis: Summary of Vaccine Recommendations.
      5. Report as a case in the WVEDSS if they meet the case definition (See section III. DISEASE INVESTIGATION - B. Case Definition and Case Classification).

c. Exposures in Childcare:
   i. Exposed children, especially incompletely immunized children, and care providers should be observed for respiratory tract symptoms for 21 days after the last contact with an infectious case-patient.
   ii. Immunization and chemoprophylaxis should be administered as recommended for household and other close contacts (See section II. DISEASE CONTROL AND

PREVENTION - C. Disease Prevention and Control Intervention and D. Treatment).

iii. Symptomatic children with probable or confirmed pertussis should be excluded from childcare pending evaluation and completion of 5 days of recommended antibiotic therapy.

iv. Untreated individuals should be excluded until 21 days have elapsed from cough onset.

10. Initiate control and prevention measures to prevent the spread of disease.
11. Record data collected during the investigation in WVEDSS.
12. Document vaccine information in WVEDSS.
    a. Vaccine information should be verified using the West Virginia Statewide Immunization Information System (WVSIIS). Regional epidemiologists and LHD epidemiology staff should obtain viewing access to WVSIIS to obtain vaccine information for vaccine-preventable disease investigations. Enrollment information can be found here: wvimm.org/wvsiis/main.jsp .
    b. The patient's provider may also be able to provide vaccine records for a patient. If the vaccine information is not already captured in WVSIIS, please submit a copy of the vaccine record to the Vaccine-Preventable Disease Epidemiologist at DIDE so that the record can be entered in WVSIIS.
        i. The vaccine information should also be entered into WVEDSS by the LHD or regional epidemiologist.

H. State Health Responsibilities

1. Review and evaluate all paper and electronic laboratory reports (ELR) submitted to DIDE.
    a. Assign possible cases of pertussis to appropriate local health jurisdiction in WVEDSS for investigation within 24 hours of positive paper laboratory report or ELR notification.
2. Provide support and guidance to regional epidemiologists and local health jurisdictions on surveillance, investigation, outbreak response, control measures, identification of close contacts, post exposure prophylaxis and prevention of pertussis.
3. Ascertain case reports and review case investigations submitted in WVEDSS. Notify CDC through the National Notifiable Disease Surveillance System (NNDSS) in a timely manner.
4. In the event of an outbreak or cluster of cases:
    a. Identify and support local health needs,
    b. Assist public health response; and
    c. Notify appropriate public health partners as needed including the LHDs, OLS, and CDC.
5. Update information sheets, surveillance protocol, and toolkits as new information becomes available.

6. Develop and send Health Alerts when necessary.
7. Summarize surveillance data and surveillance indicators periodically.
    a. Share information with public health partners and CDC.

I. Occupational Health

1. Healthcare facilities should immunize all healthcare personnel (HCP) with Tdap. A single dose of Tdap is recommended for healthcare personnel who have not previously received Tdap and who have direct patient contact, including face-to-face interviewing of the case patient (See section II. DISEASE CONTROL AND PREVENTION – C. Disease Prevention and Control Intervention).
2. HCP should observe droplet precautions when examining a patient with pertussis. In addition to standard precautions, droplet precautions are recommended for five days after initiation of effective therapy. If appropriate antimicrobial therapy is not given, droplet precautions are recommended until three weeks have passed after cough onset.
3. HCP exposed to a person with pertussis should be evaluated for postexposure management and follow-up. Some immunized HCP are still at risk of *B. pertussis* infection.
    a. PEP is recommended for all HCP (even if immunized with Tdap) who have been exposed to pertussis and are likely to expose patients at risk of severe illness. Other exposed HCP should either receive PEP or be monitored for 21 days after exposure and treated at the onset of signs and symptoms of pertussis.
4. HCP with symptoms of pertussis (or HCP with any respiratory illness within 21 days of exposure to pertussis) should be excluded from work for at least the first five days of recommended antimicrobial treatment. HCP with symptoms of pertussis who do not accept antimicrobial treatment should be excluded from work for 21 days from cough onset.

IV. DISEASE SURVEILLANCE

A. Public Health Significance

Pertussis, more commonly known as whooping cough, is a contagious respiratory disease caused by the bacterium *Bordetella pertussis*. Outbreaks of pertussis were first described in the 16th century, and the organism was first isolated in 1906. In the pre-vaccine era, pertussis was a common childhood disease and a major cause of childhood mortality in the United States. Introduction of the first pertussis vaccine in the 1940s resulted in a substantial reduction in the number of cases; however, the incidence of pertussis has steadily increased since the 1980s with notable peaks over the past decade. Multiple factors have likely contributed to the increase, including waning immunity from acellular pertussis vaccines, heightened provider, and public awareness, improved diagnostic testing, and possibly molecular changes within the bacterium itself. Pertussis rarely causes severe complications among healthy, vaccinated persons. Infants, however, are at greatest risk for pertussis-related complications and

mortality. Pneumonia is the most common complication in all age groups; seizures and encephalopathy are rare and primarily occur among very young infants. Death is infrequent and most likely to occur in unvaccinated infants, although fatalities are occasionally reported among older children and adults with serious underlying medical conditions.

B. Disease Surveillance Objectives

1. Determine the incidence of pertussis in West Virginia.
2. Determine if cases are due to failure to vaccinate or vaccine failure.
3. Identify sources and sites of transmission.
4. Reduce or prevent the spread of disease.

C. Surveillance Indicators

1. Proportion of investigations with complete demographic information (name, date of birth, address, sex, race, ethnicity).
2. Proportion of investigations with complete information (clinical case definition, complications*, antibiotic treatment, laboratory testing, vaccination history, and epidemiologic data**).
3. Interval (median time) between date of symptom onset and date of public health notification.
4. Proportion of cases reported to public health within 24 hours.
5. Proportion of probable and confirmed cases meeting the clinical case definition that are laboratory confirmed.
6. Proportion of probable and confirmed cases reported with complete vaccine history.

*Complications include information on hospitalization, presence of whoop, post-tussive vomiting, and paroxysmal cough, apnea, chest x-rays for pneumonia, seizures, and encephalopathy.

**Epidemiologic data includes indicating if a case is part of an outbreak, if a case is epi-linked to another case, and if contact tracing was completed.

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