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Date: May 7, 2019

To: Medical Professionals

From: Jeff Kindrai, MSPH, RS
Director/Health Officer

RE: Pertussis in Grant County

Please be aware that we are currently identifying Pertussis cases in Grant County. In light of this, Grant County Health Department would like to remind area providers to check the immunization status of both staff and patients and to consider Pertussis as a possible diagnosis.

I have attached the most recent Pertussis guidance for your review. Page 5 covers tests, pages 14-15 cover treatment and post-exposure prophylaxis (PEP) and pages 16 and 17 provide algorithms that cover clinical evaluation and contact management. In general, those suspected of having Pertussis should:

- Be tested using a NP Swab and a PCR method, ideally within the first 21 days of the onset of cough. Information on obtaining test kits or sample collection procedures is available by calling the Wisconsin State Lab of Hygiene at 1-800-862-1088 (Kit # 30). Note that a culture should also be done if possible.

- Be treated appropriately with antibiotics at the time of testing if the patient has been coughing ≤ 21 days.

- Be isolated and excluded from work, school, and daycare until 5 days of appropriate treatment has been completed. If the patient has been coughing > 21 days isolation and exclusion is not necessary

- Be reported to Grant County Health Department within 24 hours at (608) 723-6416 (or (608) 723-2039 after normal hours, weekends, and holidays ONLY).

- Close contacts to Pertussis cases should be treated prophylactically. (Generally, household members, face-to face contacts, droplet exposures, and those in close proximity for > 1 hour.) Note the recommendations starting on p. 8 of the guidance including guidance for health care setting (starting on page 9).

A "Clinical Case" is defined as a cough illness lasting ≥2 weeks with one or more of the following: paroxysms of coughing, inspiratory "whoop", or post-tussive vomiting, without other apparent cause (and Apnea with or without cyanosis (for infants <1 year only).

Note that a negative test does not rule out Pertussis. However, testing helps ensure proper diagnosis allowing for follow up including identifying case contacts and prophylaxis opportunities. Up to date immunizations, as well as aggressive testing, treatment, isolation, and follow up on contacts including prophylaxis (when appropriate) are important components in our efforts to control the spread of Pertussis.

Grant County Health Department would like to thank you for your expertise, efforts, and assistance in promoting and protecting the health of Grant County residents. If you have any questions regarding this matter or if we can be of assistance with any other issues please do not hesitate to contact us at (608) 723-6416 or visit www.co.grant.wi.gov.

Pertussis

(Also known as Whooping Cough)

Section 1: ABOUT THE DISEASE

A. Etiologic Agent

Pertussis is caused by *Bordetella pertussis*, a fastidious, gram-negative, pleomorphic bacillus.

B. Clinical Description

Presentation
The clinical course of classic pertussis is divided into three stages: catarrhal, paroxysmal, and convalescent.

The catarrhal stage is characterized by the insidious onset of symptoms similar to the common cold: runny nose, sneezing, low-grade fever, and a mild occasional cough. The cough gradually becomes more severe and after 1-2 weeks, the paroxysmal stage begins.

The paroxysmal stage is characterized by the patient having bursts (paroxysms) of numerous, rapid coughs, apparently resulting from difficulty expelling thick mucus from the tracheobronchial tree. At the end of the paroxysm, the patient may breathe in strongly which may be accompanied by a characteristic high-pitched whoop. During such an attack, the patient may turn blue (cyanotic). Children and young infants often appear very ill and distressed. Vomiting and exhaustion commonly follow paroxysmal episodes. The person does not appear ill between attacks. Paroxysmal attacks occur more frequently at night. The paroxysmal stage typically lasts 1-6 weeks, but may persist for up to 10 weeks. During the first 1-2 weeks of the paroxysmal stage, the attacks increase in frequency, remain at the same level for 2-3 weeks, and then gradually decrease. Infants aged <6 months may not have the strength to have a whoop, but they do have paroxysms of coughing.

The convalescent stage is characterized by gradual recovery. The cough becomes less paroxysmal and disappears in 2-3 weeks. However, paroxysms often recur with subsequent respiratory infections for many months after the onset of pertussis.

The clinical presentation of pertussis varies with age, and the diagnosis can be challenging. Disease in infants aged <6 months may be atypical, with a short catarrhal stage and gagging, gasping, or apnea as the prominent early manifestations. Whoop may be absent and the convalescent stage may be prolonged. Older children and adults can present with the classic symptoms of pertussis or with an atypical presentation. Among immunized individuals, particularly adolescents and adults, prolonged cough may be the only manifestation of pertussis.

Complications
Pertussis is most severe when it occurs during the first 6 months of life, particularly in preterm and underimmunized infants. Complications include primary or secondary bacterial pneumonia, seizures, hypoxic encephalopathy, and death. Most pertussis-related deaths occur in infants, particularly among those aged <4 months. Conditions that may result from the effects of pressure generated by severe coughing include pneumothorax, epistaxis, subconjunctival hemorrhage, subdural hematoma, hernia, rectal prolapse, urinary incontinence, and rib fracture. Adolescents and adults may also develop complications of pertussis, including problems sleeping, urinary incontinence, pneumonia and rib fracture.

Differential Diagnosis
Physicians should include pertussis in their differential diagnosis for patients in all age groups who present with a prolonged cough illness. The differential diagnosis for pertussis often includes infections caused by *Mycoplasma pneumoniae*, *Chlamydia trachomatis*, *Chlamydia pneumoniae*, respiratory syncytial virus (RSV), adenovirus, other respiratory viruses, and other *Bordetella* species (e.g., *B. parapertussis* and *B. holmseii*).

Despite increasing awareness and recognition of pertussis as a disease that affects adolescents and adults, pertussis is often overlooked in the differential diagnosis of cough illness in this population. Also, adolescents and

adults often do not seek medical care until several weeks after the onset of their illness. Therefore, in addition to the agents listed above, the differential diagnosis among older age groups may include other causes of chronic cough, such as bronchospasm, gastroesophogeal reflux disease, post viral bronchospasm, sinusitis, and chronic lung disease.

Immunity
Neither natural infection with nor vaccination against *B. pertussis* provides lifelong immunity to *B. pertussis*. Vaccination with DTaP (diphtheria-tetanus-acellular pertussis vaccine) and Tdap (tetanus-diphtheria-acellular pertussis vaccine) are the best available methods for preventing pertussis (see section 1I).

C. Reservoirs

Humans are the only host of *Bordetella pertussis*.

D. Modes of Transmission

B. pertussis is transmitted from person to person by: (1) direct contact with nasopharyngeal secretions of an infected person, or by (2) contact with droplets of nasopharyngeal secretions from an infected person. Droplets are generated during coughing, sneezing, or talking, and during the performance of certain procedures such as bronchoscopy or suctioning. These particles can be propelled through the air for distances of approximately three feet. Examples of direct or droplet contact with nasopharyngeal secretions include a cough or sneeze in the face, sharing food, sharing eating utensils during a meal, kissing, and performing a full medical exam including examination of the nose and throat.

E. Incubation Period

The incubation period is usually 7-10 days, with a range of 5-21 days.

F. Period of Communicability or Infectious Period

The period of communicability depends on whether the patient has been treated with appropriate antibiotic therapy (see Appendix A for definition of appropriate antibiotic therapy) and the patient's age:

Treated with appropriate antibiotic therapy?	Age of patient	Start of Infectious Period	End of Infectious Period
Yes	All ages	7 days before cough onset	After 5th day of treatment
No	≥1 year	7 days before cough onset	21 days after cough onset
No	<1 year	7 days before cough onset	42 days after cough onset

To determine a pertussis patient's infectious period, it is helpful to have a calendar. The critical piece of information is the day the patient began coughing, which is considered day zero. This information is usually obtained during follow-up with the health care provider and from the patient.

For example, patient A (aged 11 years) began coughing on January 15th. To determine the infectious period, first count back 7 days from the day of cough onset. This would be January 8th. Then count forward 21 days from the date of cough onset. This would be February 5th. Therefore, the infectious period is from January 8th through February 5th. However, if the individual received appropriate antibiotics within that time period, the infectious period would end after the first five days of full adherence to a course of an appropriate antibiotic.

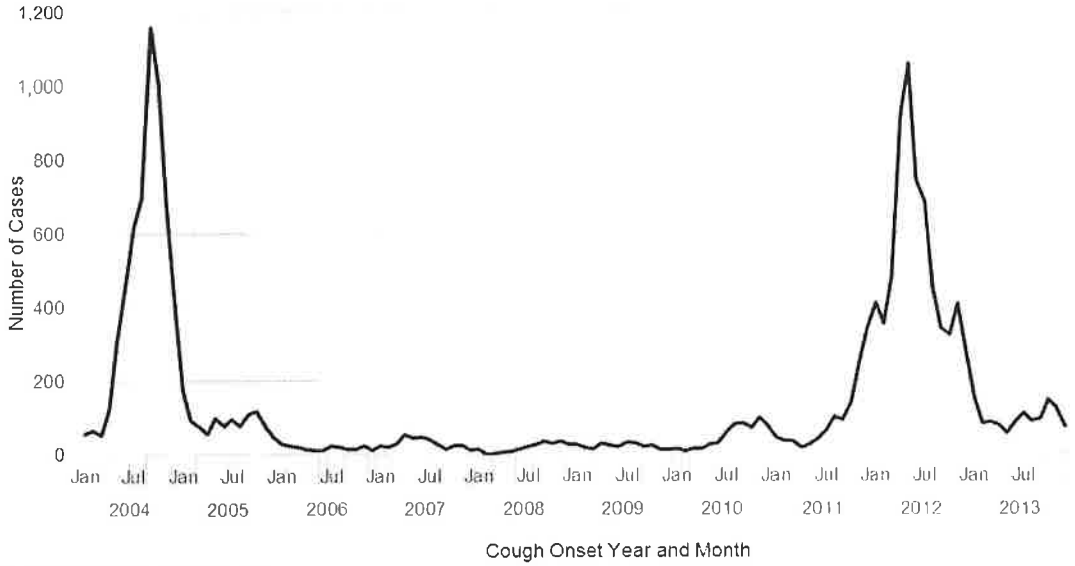
G. Epidemiologic Features

Pertussis occurs worldwide. It is endemic, with peaks of disease incidence occurring every 2–5 years. Pertussis is highly infectious, with secondary attack rates of 80% among non-immune household contacts. Following introduction of pertussis vaccine during the 1940s, pertussis incidence gradually fell in the United States. Since the 1980s, the incidence of reported pertussis has increased in the United States among all age groups. Infants aged <1 year, who are at greatest risk for severe disease and death, continue to have the highest reported incidence of pertussis. Children aged 7-10 years continue to contribute a significant proportion of reported

pertussis cases, and pertussis is increasing among adolescents aged 13-14 years. For up-to-date information on national pertussis trends, see the Centers for Disease Control and Prevention (CDC) pertussis website: http://www.cdc.gov/pertussis/about/index.html.

Since 2003, Wisconsin has experienced two large, statewide outbreaks of pertussis during 2003-2005 and 2011-2012 (Figure 1). During 2012, 6,462 cases were reported among Wisconsin residents. The incidence of pertussis was highest among infants aged <1 year and adolescents aged 10-14 years. Among the 367 reported pertussis patients aged <1 year, 60 (16%) were hospitalized and 3 (<1%) died. For up-to-date information on pertussis in Wisconsin, see the Wisconsin Division of Public Health (WDPH) pertussis website under 'Data and statistics': http://www.dhs.wisconsin.gov/immunization/pertussis.htm.

Figure 1: Number of confirmed and probable cases of pertussis, by year of cough onset, Wisconsin, 2004-2013



H. Prevention Measures

The best available methods for the prevention of pertussis include:

- Routine vaccination against pertussis (see Section 1I),
- Appropriate and timely use of post-exposure antimicrobial prophylaxis (see Section 4B),
- Good personal hygiene (which consists of proper hand hygiene, disposal of used tissues, and covering your cough).

I. Immunization

The Advisory Committee for Immunization Practices (ACIP) and CDC recommendations for routine vaccination with DTaP and Tdap vaccines are summarized below.

Recommendations for Routine Vaccination with DTaP and Tdap Vaccine

- **Children aged 6 weeks through 6 years** should routinely receive pertussis vaccine as DTaP. The primary series of four doses should be received at 2, 4, 6, and 15-18 months of age. A booster dose should be received at school entry (4-6 years of age).
- **Children aged 7 through 10 years not fully vaccinated** against pertussis (fully vaccinated is defined as five doses of DTaP or four doses of DTaP if the fourth dose was administered on or after the fourth birthday) should receive a single dose of Tdap.
- **Children aged 11-12 years** who have not already received Tdap should routinely receive a booster dose of Tdap vaccine. Tdap vaccine is administered as a one-time booster dose.
- **Adolescents and adults** who have not already received Tdap should be administered a dose of Tdap in place of their next Td (tetanus-diphtheria vaccine) booster or whenever vaccination with Tdap is indicated.

- **Adolescents and adults who have or anticipate having contact with an infant** aged <1 year should receive a dose of Tdap as soon as feasible if they have not previously received Tdap and regardless of time since last Td dose.
- **Pregnant women** should receive Tdap during every pregnancy, optimally between the 27th and 36th week of gestation. For pregnant women not previously vaccinated with Tdap, if Tdap is not administered during pregnancy, Tdap should be administered immediately postpartum.
- **Health care personnel** regardless of age should receive a dose of Tdap as soon as feasible if they have not previously received Tdap and regardless of time since last Td dose.

For more information on DTaP or Tdap vaccination, please access:
- The most current versions of the ACIP statement on DTaP or Tdap: http://www.cdc.gov/vaccines/hcp/acip-recs/index.html
- Frequently asked questions about pertussis vaccination: http://www.cdc.gov/vaccines/vpd-vac/pertussis/default.htm.
- DTaP and Tdap Vaccine Information Statements (VIS): http://www.cdc.gov/vaccines/hcp/vis/index.html.

A Pertussis Public Health Fact Sheet for the general public can be obtained from the WDPH website at: http://www.dhs.wisconsin.gov/immunization/pertussis.htm

Section 2: REPORTING CRITERIA AND LABORATORY TESTING

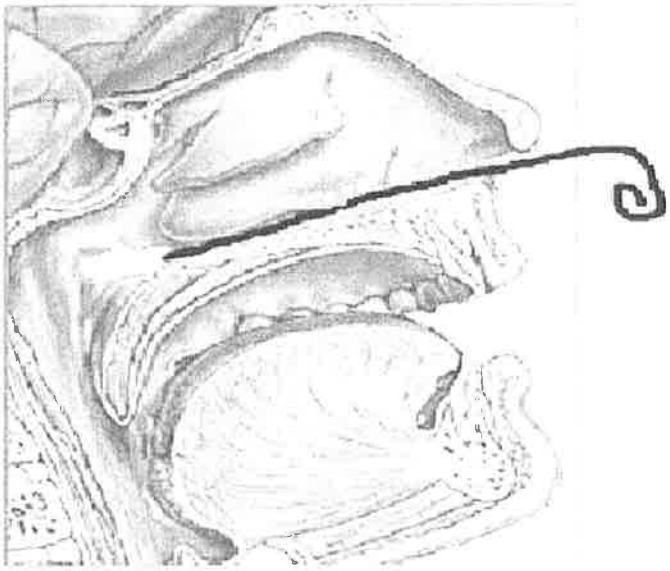
A. What to Report to the Wisconsin Division of Public Health (WDPH)

Report any of the following:
- An individual with a suspected case of pertussis, as diagnosed by a health care provider;
- Isolation, by culture, of *B. pertussis* from a clinical specimen;
- A positive polymerase chain reaction (PCR) test result for *B. pertussis* nucleic acid;
- Cough illness in a contact of a person with a laboratory-confirmed case of pertussis.

B. Specimen Collection and Laboratory Testing

Specimen Collection
- **Only symptomatic persons should have specimens collected for *B. pertussis* testing.**
- Nasopharyngeal (NP) swabs are the recommended specimen for pertussis testing and should be collected as soon as pertussis is suspected (preferably within 21 days of cough onset) for the best chance of detection of the bacteria.
- A diagram of NP specimen collection is shown in Figure 2. When collecting specimens, gently insert the swab into one nare and proceed gently to the posterior wall of the pharynx (see diagram below). Do not direct the swab upward; let it creep along the floor of the nasal cavity. Also, slightly bending the wire swab into an arc shape may allow for easier insertion into the pharynx. Do not force the swab past obstruction; try the other nare if resistance is encountered. Hold the swab in place for up to 10 seconds, or until a paroxysmal cough is elicited (or ask the patient to cough). This should ensure an adequate specimen and reduce the possibility of false negative results. Repeat with a second swab. Some practitioners have found it easier to insert both swabs at the same time, which is acceptable. After removing the swabs from the nares, place one Dacron swab into the Regan-Lowe transport tube for culture testing and cap tightly. Place the other Dacron swab into the dry, sterile transport tube for PCR testing and cap tightly. Write the patient name and the date and time of collection on each tube. Visit the following link for a demonstration of how to collect a specimen: http://www.cdc.gov/pertussis/clinical/diagnostic-testing/specimen-collection.html.

Figure 2. A sterile swab is passed through the nostril and into the nasopharynx.



Tests to be Ordered

- If possible, specimens should be collected for testing with **both** polymerase chain reaction (PCR) and culture. However, if only one specimen can be collected, it should be sent for PCR testing.
- Isolation of *B. pertussis* remains the gold standard for pertussis testing; however, the sensitivity of culture is low and the time needed to obtain results may be long (days to as long as 2 weeks). Culture is most successful in detecting *B. pertussis* during the catarrhal phase and first 14 days following cough onset. Receipt of antibiotics effective against *B. pertussis* decreases the likelihood of isolating *B. pertussis* in culture. Accordingly, if more than 14 days have elapsed since cough onset or the patient has received antibiotics effective against *B. pertussis*, testing with culture is not recommended.
- PCR is a valuable tool for the detection of *B. pertussis* because the test is substantially more sensitive than culture and results are available more rapidly. PCR is most reliable during the catarrhal phase and within the first 21 days after onset of cough and before initiation of appropriate antibiotic treatment. PCR testing following antibiotic therapy can result in false-negative findings. The exact duration of positivity following antibiotic use is not well understood, but PCR testing after 5 days of antibiotic use is unlikely to be of benefit and is generally not recommended
- Note: Direct fluorescent antibody (DFA) and serologic tests are currently not acceptable forms of laboratory confirmation of pertussis infection and therefore are not recommended.

Where to Send Specimens

- If the patient is suspected of having pertussis, the specimens should be sent to the Wisconsin State Laboratory of Hygiene (WSLH) or a commercial laboratory that performs pertussis PCR (and culture, if possible) testing.
    - Contact your local health department for details on fee-exempt testing: http://www.dhs.wisconsin.gov/localhealth/counties/countyalphalist.htm.

Submission of Specimens to WSLH

- WSLH offers testing with:
    - PCR (*Bordetella pertussis/parapertussis* PCR Test code 3224), and
    - Culture (*Bordetella* Culture Test code 623C).
- Request kit #30 and the accompanying form "CDD Requisition Form (A)" from the WSLH by calling (800) 862-1088 or (608) 265-2966. If you have questions about the testing process or specimen collection, please contact the WSLH Customer Service at (800) 862-1013.
- Kit #30 contains, among other things, 2 Dacron/polyester nasopharyngeal swabs, WSLH Regan-Lowe culture (charcoal transport) medium, and sterile tube for transport of the PCR test portion. The swab applicators use a flexible wire, which is the only device that should be inserted into the nasopharynx for the collection of the specimen. Wrap absorbent material around each tube. Place the transport tubes in the pressure bag provided

and seal. If submitting a PCR specimen, you must also place a frozen cold-pack into the Styrofoam mailer. If specimens are not shipped immediately, they should be kept at room temperature or incubated at 35°C (95°F). Optimally, the WSLH would like to receive the specimen for culture within 24 hours of collection. The dry swab specimen for PCR is relatively stable and therefore time is less critical.

- WSLH uses a Bordetella PCR test that differentiates between *B. pertussis*, *B. parapertussis*, and *B. holmesii*. Positive and negative results are reported for each of these three species. *B. holmesii* has been detected rarely in respiratory specimens from patients with pertussis-like symptoms. Its role in respiratory illness is not well defined at this time. At this time, no public health follow-up is needed for individuals who test positive for *B. holmesii*.

Interpretation of Results

- The full clinical and epidemiologic picture must be taken into consideration when interpreting test results.
- **Negative results alone *do not rule out* Bordetella infection** because:
  - The amount of bacteria in the nasopharynx at the time of sample collection may have been too low to be detected, and
  - Inadequate specimen collection, processing, shipping or storage can significantly reduce the likelihood of detecting *B. pertussis*.

Section 3: REPORTING RESPONSIBILITIES AND CASE INVESTIGATION

A. Purpose of Surveillance and Reporting

- To identify sources of infection, sites of transmission, and additional cases.
- To identify exposed persons at high risk of severe pertussis to assure timely administration of appropriate antimicrobial prophylaxis, and to prevent further spread of infection.
- To monitor the effectiveness of outbreak control strategies.
- To monitor the effectiveness of the DTaP and Tdap vaccines.

B. Laboratory and Health Care Provider Reporting Requirements

Pertussis is a Category I Reportable Disease according to WDPH regulations (DHS 145.04). Health care providers should immediately report to the local health department (LHD), by telephone, all suspected cases of pertussis, as defined by the reporting criteria in Section 2A. Within 24 hours, health care providers should submit a case report online through the Wisconsin Electronic Disease Surveillance System (WEDSS) or by fax using an Acute and Communicable Disease Case Report (F44151).

Laboratories that test specimens from Wisconsin residents that yield evidence of *Bordetella pertussis* infection should report the case to the LHD online through WEDSS or by fax using an Acute and Communicable Disease Case Report (F44151). In addition, we encourage laboratories to report to WDPH any PCR or culture results positive for *Bordetella parapertussis* or *Bordetella holmesii*.

LHD contact information can be found at: http://www.dhs.wisconsin.gov/localhealth/counties/countyalphalist.htm.

C. Local Health Department Reporting and Follow-Up Responsibilities

Reporting Requirements

Each LHD must report any suspected case of pertussis, as defined by the reporting criteria in Section 2A, to both of the following entities:

- WDPH Regional Immunization Representatives immediately by phone http://www.dhs.wisconsin.gov/immunization/CentralStaff.htm.
- WDPH, using the pertussis case report form in WEDSS.

Case Investigation

LHDs should conduct case investigations for all suspected cases of pertussis, as defined in Section 2A.

Note: If the only report received for an individual is a negative culture or negative PCR result reported to WEDSS, the LHD is encouraged to conduct a case investigation if the individual is an infant aged <1 year or is already known to be a contact of a person with pertussis. If the only report received for an individual is an equivocal or indeterminate PCR result, the LHD is encouraged to conduct a case investigation if the individual is an infant aged <1 year or is already known to have had contact with a pertussis case. If the LHD has the resources to conduct a case investigation among all individuals with equivocal/indeterminate results, the LHD is encouraged to do so.

To assess the likelihood that a suspect case is a true case prior to laboratory testing, the LHD should ask about the following. The LHD should also gather all information necessary to complete the WEDSS case report form.

- Clinical presentation, including date of onset of symptoms, particularly cough, paroxysmal cough, whoop, posttussive vomiting, apnea, duration of cough, and complications (e.g., pneumonia, hospitalization);
- Pertussis immunization history;
- Whether there was any recent contact with anyone with similar symptoms;
- Possible transmission setting (e.g., childcare, school, health care setting); and
- Laboratory testing information, including PCR and culture results.

Out-of-State Cases and Contacts
Any cases or contacts of a case identified among non-Wisconsin residents should be reported to WDPH. WDPH will notify the state of residence.

Section 4: CONTROLLING FURTHER SPREAD

This section provides guidance regarding how to control disease in a patient and how to protect contacts of a person with pertussis from becoming infected. The LHD will take the lead on implementing control measures.

The most important pieces of information that are needed to make appropriate recommendations are: (1) the date of cough onset; and (2) if/when appropriate antibiotics were taken. This information helps to determine the patient's infectious period (see Section 1F for assistance with calculations).

Vaccination with pertussis-containing vaccine is an important method for preventing pertussis. However, after someone is exposed to a patient with pertussis, antibiotic prophylaxis may be necessary to prevent the transmission of *B. pertussis*.

A. Control of Disease in a Case

Algorithm I (Appendix B) provides a guideline for how persons suspected of having pertussis should be managed in a **non-outbreak setting** and depends on the person's symptoms and whether the person had known pertussis contact.

- **Test**: Test for *B. pertussis* according to the guidance in Section 2.

- **Treatment**: A patient with pertussis should be treated with appropriate antibiotic therapy (see Appendix A) if the patient has been coughing ≤21 days (or ≤42 days if an infant aged <1 year). If the patient has been coughing for >21 days (or >42 days if an infant aged <1 year), antibiotic treatment is not necessary.

- **Isolation/Exclusion**: All suspected pertussis patients requiring treatment should be isolated and excluded from activities until 5 days of appropriate antibiotic therapy has been completed. If the patient has been coughing for >21 days (or >42 days if an infant aged <1 year), exclusion and isolation is not necessary.

If there is an **outbreak of pertussis in your community** or the health care provider has a high index of suspicion of pertussis, then the health care provider should test, treat, and isolate the patient, regardless of contact with an identified case of pertussis.

B. Protection of Contacts of a Case

Algorithm II (Appendix C) depicts how individuals who have had close contact with a patient with pertussis should be managed. In brief, symptomatic close contacts should be managed as having suspected cases of pertussis. Post-exposure prophylaxis (PEP) with appropriate antibiotics should be targeted to (i) household contacts, (ii) close contacts at highest risk of severe disease (e.g., infants), and (iii) close contacts who will come in contact with those at highest risk of severe disease.

Step 1: Identify Close Contacts

- Work with the patient (or parent/guardian) to identify individuals who had close contact with the patient while the patient was infectious. Close contact includes:
  - Direct face-to-face contact for a period of time (duration not defined).
  - Shared confined space in close proximity for a prolonged period of time, such as ≥1 hour.
  - Direct contact with respiratory, oral, or nasal secretions (e.g., an explosive cough or sneeze in the face). Note: Droplet precautions apply only if the suspected exposure occurred within a three-foot radius.
  - Contact in a setting with known pertussis transmission (e.g., two or more cases in same classroom or sports team).
  - Household contacts (including roommates in dormitories).

Step 2: Notify Close Contacts and Identify those at High Risk

- Notify close contacts of their exposure to a pertussis case.
- Identify close contacts who are included in a high-risk category.
  High-risk categories include:
  A. **Household contacts**. At high risk for developing pertussis. Secondary attack rates of pertussis among household contacts have been demonstrated to be high, even when the household contacts are up-to-date with pertussis immunizations.
  B. **Infants aged <1 year**. At high risk for severe disease and serious complications.
  C. **Pregnant women in their third trimester**. At high risk of transmitting *B. pertussis* to their newborn infants.
  D. **Individuals with pre-existing health conditions that may be exacerbated by pertussis infections** For example, but not limited to, immunocompromised persons, patients with moderate to severe medically treated asthma. At high risk for severe disease and serious complications.
  E. **Anyone who will have contact with anyone in groups B, C or D above.** At high risk of transmitting pertussis to individuals who are at high risk for severe disease and serious complications.

Step 3: Manage Close Contacts

For close contacts in a high-risk category:

- Recommended PEP with appropriate antibiotics (see Appendix A) if last exposure to the pertussis patient was within 21 days.
- If pertussis symptoms are present or develop, the individual should be managed as having a suspected case of pertussis (see section 4A).

For close contacts not in a high-risk category:

- Monitor for signs and symptoms of pertussis for 21 days after last exposure to the patient with pertussis.
- If pertussis symptoms are present or develop, the individual should be managed as a suspected case of pertussis (see section 4A).

For close contacts who are not residents of Wisconsin:

- Contact WDPH. WDPH will notify the other state's health department.

Note: When continued transmission of *B. pertussis* is evident, multiple rounds of antibiotics are not recommended. Rather than repeating a course of antibiotics, contacts should be monitored for onset of signs and symptoms of pertussis for 21 days. However, in some situations (e.g., re-exposure of an infant aged <6 months) re-prophylaxis may be warranted.

C. Management in Special Settings

School Settings

- The LHD and school should work together to identify close contacts (including staff members and students) of the patient with pertussis.
    - To identify close contacts at high risk for whom PEP should be recommended, the LHD and the school may choose to send a letter to all close contacts providing instructions about what to do if they are in a high-risk group or if they are not in a high-risk group. Close contacts should be notified that they have been exposed to a case of pertussis and:
        - If they have a cough illness, medical evaluation for pertussis should be sought.
        - If they do not have a cough but are included in one of the high-risk groups (B-E listed above), PEP should be requested from the medical provider.
        - If they do not have a cough and are not included in one of the high-risk groups (B-E listed above), they should be monitored for 21 days after last exposure to the patient with pertussis and seek medical evaluation if symptoms develop.
- A general letter describing pertussis may be sent to others in the school who did not have close contact with the patient with pertussis.
- Template letters are available from WDPH.

Settings with Infants or Pregnant Women in their Third Trimester

If a case of pertussis is identified in a setting that includes infants or pregnant women in their third trimester (for example, but not limited to, child care settings, NICUs, maternity wards), please contact WDPH for consultation. In this situation, WDPH may advise that all close contacts be recommended PEP to limit the possibility of transmission of *B. pertussis* to infants.

Limited, Closed Settings

If a small outbreak of pertussis occurs in a closed setting (such as a prison) and a community-wide outbreak is not ongoing, a broader use of PEP may be warranted to interrupt *B. pertussis* transmission in that closed setting. If continued transmission occurs in that setting, multiple rounds of PEP are not recommended. Instead, contacts should be monitored for signs and symptoms for 21 days. Please contact WDPH for consultation if such an outbreak occurs in your jurisdiction.

Health Care Settings

In the health care setting, the control of disease in a patient and management of close contacts should generally follow the guidelines described in Sections 4A and 4B. However, see below for additional guidance for controlling disease among health care personnel and patients.

Definition of close contact in health care setting:

In addition to the definition of a close contact outlined in Section 4B, in health care settings the definition of a close contact also includes the following:

- Having face-to-face contact within three feet of the patient with pertussis without wearing a surgical mask or other protection of the face and respiratory tract; this includes performing a medical examination, obtaining a NP swab specimen, suctioning, intubating or performing bronchoscopy or a similar procedure without wearing a mask.
- Conducting any procedure that induces coughing of the patient without wearing a surgical mask or other protection of the face and respiratory tract, even if farther from the patient than three feet.
- Coming into direct mucosal contact with respiratory, oral or nasal secretions of the patient or via fomites.
- Sharing a room with the patient; the degree of contact and risk of infection in such situations should be evaluated on a case-by-case basis.
- Having any other close contact with a patient, as defined in Section 4B.
- In general, individuals who were in waiting rooms or other care areas at the same time as a patient with pertussis should not be considered close contacts.

Note: If a surgical mask was worn by the patient and/or the contact during the entire exam, including specimen collection, there is no need for prophylaxis of the contact. However, this guidance is only for assessing exposures

that have already occurred and does not allow a health care provider who is infectious with pertussis to continue working, even if wearing a mask.

Additional guidance for management of health care personnel and patients:
Management in high-risk settings:

- In high-risk settings, such as NICUs, maternity wards or other settings with infants, pregnant women in their third trimester of pregnancy, or immunocompromised individuals, WDPH may recommend PEP for all individuals in the setting to limit spread of *B. pertussis* to those at high risk of severe pertussis. Contact WDPH for consultation.

Management of health care personnel who had close contact with a case:

- Data regarding the need for PEP among health care personnel who have received Tdap is inconclusive. Certain vaccinated health care personnel are still at risk for *B. pertussis*. Tdap might not preclude the need for PEP.
- Therefore, PEP is recommended if the health care personnel had unprotected exposure to pertussis and is likely to expose a patient at high risk for severe pertussis (e.g., hospitalized neonates, pregnant women in their third trimester, individuals with pre-existing conditions that will be exacerbated by infection with *B. pertussis*).
- Other health care personnel should either (a) receive PEP or (b) be monitored daily for 21 days after pertussis exposure and treated at the time of onset of signs and symptoms of pertussis (and be excluded through day 5 of a regimen of appropriate antibiotics if they become symptomatic).

Management of inpatients with pertussis:

- If it has been ≤21 days (≤42 if an infant aged <1 year) from the patient's cough onset, isolate the inpatient with confirmed or suspect pertussis. The patient should be placed on droplet precautions until completion of 5 days of treatment with an appropriate antibiotic.

Notification:

- Within the health care setting, providers, department heads, infection prevention personnel, employee health, and other relevant personnel/departments should be notified of confirmed and suspect cases.
- The local health department should be notified of any suspected pertussis cases in a health care setting.

Conduct Active Surveillance:

- Continue cough surveillance for two incubation periods (42 days) after the date of cough onset in the last case. This is of utmost importance in settings and situations involving high-risk individuals.

Section 5: CASE DEFINITIONS

The following are the Wisconsin and CDC surveillance case definitions for pertussis. They are used for public health surveillance and reporting purposes only and should **not** affect the management, investigation or reporting of a case that fulfills the criteria in Section 2A. The CDC and the WDPH use the following case definitions to maintain uniform standards for national reporting. For reporting to the WDPH, always use the criteria outlined in Section 2A.

The most up-to-date CDC case definitions are available on the CDC website at:
http://www.cdc.gov/pertussis/surv-reporting.html.

Case Definition for Pertussis (As Defined by CDC and WDPH, 2014)

Clinical Case Definition
In the absence of a more likely diagnosis, a cough illness lasting ≥2 weeks with one of the following symptoms:

- Paroxysms of coughing, OR
- Inspiratory "whoop," OR
- Posttussive vomiting, OR
- Apnea (with or without cyanosis) (FOR INFANTS AGED <1 YEAR ONLY)

Laboratory Criteria for Diagnosis
- Isolation of *Bordetella pertussis* from clinical specimen
- Positive polymerase chain reaction (PCR) for *B. pertussis*

Epidemiologic Linkage
Contact with a laboratory-confirmed case of pertussis*

Case Classification
Confirmed:
Acute cough illness of any duration with isolation of *B. pertussis* from a clinical specimen
OR
Meets the clinical case definition AND is polymerase chain reaction (PCR) positive for pertussis
OR
Meets the clinical case definition AND had contact with a laboratory-confirmed case of pertussis

Probable:
Meets the clinical case definition, is not laboratory confirmed, and is not epidemiologically linked to a laboratory-confirmed case

OR

FOR INFANTS AGED <1 YEAR ONLY:
- Acute cough illness of any duration with at least one of the following signs or symptoms:
  - Paroxysms of coughing, OR
  - Inspiratory "whoop", OR
  - Posttussive vomiting, OR
  - Apnea (with or without cyanosis)

  AND
- Polymerase chain reaction (PCR) positive for pertussis

OR

FOR INFANTS AGED <1 YEAR ONLY:
- Acute cough illness of any duration with at least one of the following signs or symptoms:
  - Paroxysms of coughing, OR
  - Inspiratory "whoop", OR
  - Posttussive vomiting, OR
  - Apnea (with or without cyanosis)

  AND
- Contact with a laboratory-confirmed case of pertussis

Case Classification Comments:
***Note:** An illness meeting the clinical case definition should be classified as "probable" rather than "confirmed" if it occurs in a patient who has contact with an infant aged <1 year who is polymerase chain reaction (PCR) positive for pertussis and has ≥1 sign or symptom and cough duration <14 days (classified as "probable" case).

Suspect (WDPH)
A clinical syndrome or illness consistent or compatible with pertussis and without other apparent cause that does not meet the definition of Confirmed or Probable, such as:
- Any acute cough illness with paroxysmal cough or inspiratory whoop
- Any acute cough illness in a person who is a close contact to a patient with a confirmed or probable case
- Any acute cough illness lasting ≥7 days when there is a reported outbreak of pertussis in the community
- Any acute cough illness with positive PCR results for *B. pertussis* that does not meet any other case definition of pertussis.

Epidemiologic link (WDPH)

An individual with an epidemiologic link:

- Had close contact with a patient who had a laboratory-confirmed case AND that close contact occurred while the patient was infectious

  AND
- Had illness onset 5-21 days (the incubation period of pertussis) after* close contact with the patient who had a laboratory-confirmed case.

*Note: An individual with an epidemiologic link may have onset before or after disease onset in the patient with a laboratory-confirmed case.

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DTaP

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Abbreviation: CDC, Centers for Disease Control and Prevention

APPENDIX A – Recommended Antibiotic Treatment and Prophylaxis of Pertussis

Antibiotics administered during the catarrhal stage of pertussis may ameliorate the disease. After the cough is established, antibiotic treatment may have no discernible effect on the course of illness but is recommended to reduce the duration of spread of *Bordetella pertussis* to 5 days after initiation of appropriate antibiotic treatment. The duration of spread from an untreated person is approximately 7 days before the onset of cough to 21 days after the onset of cough.

A macrolide (typically azithromycin but also erythromycin or clarithromycin) is the antibiotic of choice for pertussis related treatment and prophylaxis. Following are age-specific antibiotic treatment and prophylaxis recommendations, with a summary Table on the next page. The dosage, frequency, and duration of use of these antibiotics when used for prophylaxis are the same as when used for treatment. Any treatment schedule which differs from those described in this document is not recommended.

Providers should consider safety, potential interactions with concurrent medications, adherence to the prescribed regimen, and cost when choosing an appropriate antibiotic for any patient.

Treatment
Initiate treatment of persons aged ≥1 year within 21 days of cough onset. Initiate treatment of infants aged <1 year within 42 days of cough onset. No antibiotic treatment is indicated when a patient has been coughing for >21 days (if aged ≥1 year) or >42 days (if aged <1 year).

Prophylaxis of Close Contacts
In general, antibiotic prophylaxis of high-risk close contacts is recommended if it is initiated within 21 days of close contact with the patient with pertussis (Appendix C, Algorithm II). When continued transmission of pertussis is evident, multiple rounds of antibiotics are not recommended. Rather than repeating a course of antibiotics, close contacts should be monitored for onset of signs and symptoms of pertussis for 21 days after last exposure to the case. However, in some situations (e.g., re-exposure of an infant aged <6 months) re-prophylaxis may be warranted.

1. **Azithromycin**
   Recommended regimen (azithromycin is administered as a single daily dose):
   - Infants aged <6 months: 10 mg/kg per day for 5 days.
   - Infants aged ≥6 months and children: 10 mg/kg (maximum: 500 mg) on day 1, followed by 5 mg/kg per day (maximum: 250 mg) on days 2-5.
   - Adults: 500 mg on day 1, followed by 250 mg per day on days 2-5.

2. **Erythromycin**
   Recommended regimen:
   - Infants aged <1 month: not preferred because of risk for infantile hypertrophic pyloric stenosis (IHPS). Azithromycin is the recommended antimicrobial agent. If azithromycin is not available and erythromycin is used, the dose is 40-50 mg/kg per day in 4 divided doses for 14 days. Monitor infant for IHPS.
   - Infants ≥1 month and older children: 40-50 mg/kg per day (maximum: 2 g per day) in 4 divided doses for 14 days.
   - Adults: 2 g per day in 4 divided doses for 14 days.

   A 14-day course of erythromycin is recommended for treatment or for post-exposure prophylaxis of close contacts of pertussis patients because relapses have been reported after completion of 7-10 days of treatment.

3. **Clarithromycin**
   Recommended regimen:
   - Infants aged <1 month: not recommended.
   - Infants aged ≥1 month and children: 15 mg/kg per day (maximum: 1 g per day) in 2 divided doses each day for 7 days.
   - Adults: 1 g per day in 2 divided doses for 7 days.

4. **Trimethoprim-Sulfamethoxazole (TMP-SMX)** Alternative treatment for patients who have contraindications to the use of macrolides.TMP-SMX may be used as an alternative agent in patients who are allergic to macrolides, who cannot tolerate macrolides, or who are infected, rarely, with a macrolide-resistant strain of *B. pertussis*. TMP-SMX should not be administered to pregnant women, nursing mothers, or infants aged <2 months.
   Recommended regimen:
   - Infants aged <2 months: contraindicated.
   - Infants aged ≥2 months and children: trimethoprim 8 mg/kg per day, sulfamethoxazole 40 mg/kg per day in 2 divided doses for 14 days.
   - Adults: trimethoprim 320 mg per day, sulfamethoxazole 1,600 mg per day in 2 divided doses for 14 days.

5. **Other antimicrobial agents**
   Although in vitro activity against B. pertussis has been demonstrated for other macrolides (e.g., roxithromycin and ketolides), no published data exist on the clinical effectiveness of these agents. No other antimicrobial agents are recommended for treatment or post-exposure prophylaxis of pertussis because their clinical effectiveness has not been proven or because of their potentially harmful side effects in children.

Table. Recommended antimicrobial treatment and post-exposure prophylaxis for pertussis, by age group.

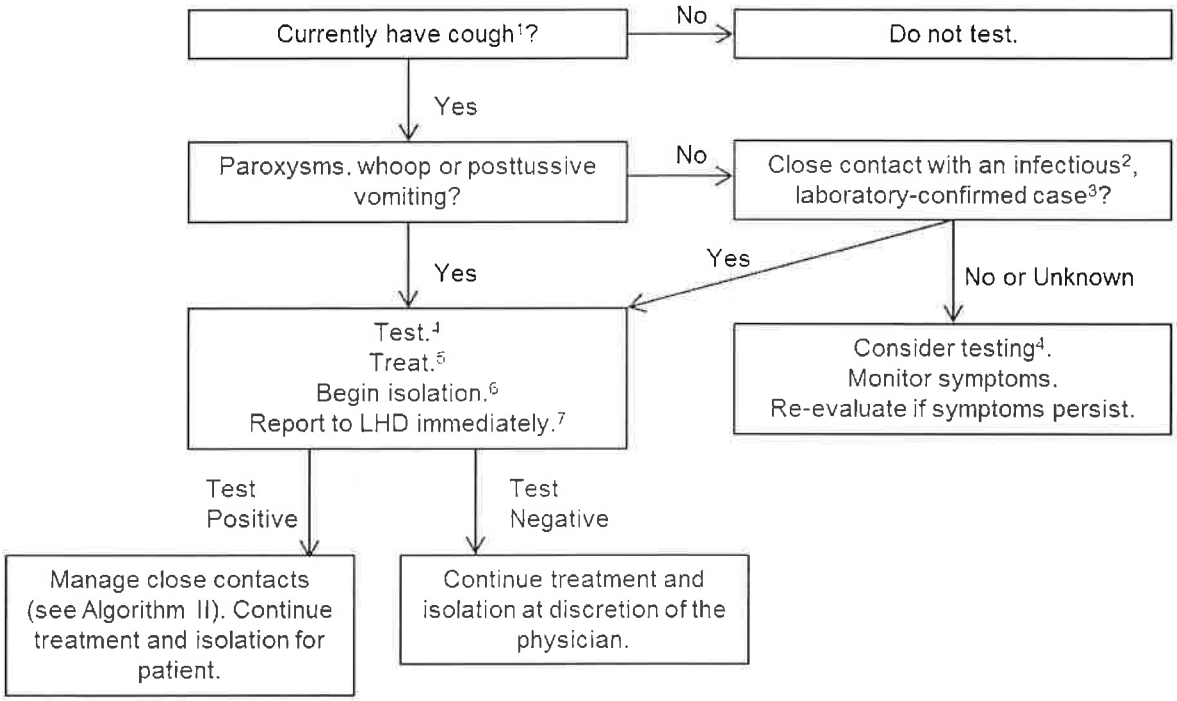
Age group	Azithromycin	Erythromycin	Clarithromycin	Alternate agent* TMP-SMX
<1 month[a]	Recommended agent. 10 mg/kg per day in a single dose for 5 days (only limited safety data available)	Not preferred. Erythromycin is associated with infantile hypertrophic pyloric stenosis. Use if azithromycin is unavailable; 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, SMX 40 mg/kg per day in 2 divided doses for 14 days
Infants (aged ≥6 months) and children	10 mg/kg (maximum: 500 mg) in a single dose on day 1 then 5 mg/kg per day (maximum: 250 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, SMX 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, SMX 1,600 mg per day in 2 divided doses for 14 days

*Trimethoprim sulfamethoxazole (TMP–SMX) 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*. Because of the potential risk for kernicterus among infants, TMP-SMX should not be administered to pregnant women, nursing mothers or infants aged <2 months.

[a]Infants <1 month of age who receive any macrolide should be monitored for the development of IHPS for one month after completing the course.

CDC. Recommended antimicrobial agents for the treatment and postexposure prophylaxis of pertussis: 2005 CDC guidelines. MMWR 2005. http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5414a1.htm

Appendix B – Algorithm I: Clinical Evaluation and Management of Persons in Whom Pertussis is Being Considered



[1]Infants aged <1 year might present only with apnea. Proceed to "Test, treat, begin isolation and report to LHD immediately" if pertussis is strongly suspected.

[2]The infectious period is defined as 1 week before cough onset to 21 days after cough onset if untreated or 5 days after initiation of appropriate antibiotic therapy. Infants aged <1 year with pertussis remain infectious for longer periods (up to 42 days from cough onset) if untreated.

[3]The person being evaluated must have had illness onset within 5-21 days after this close contact.

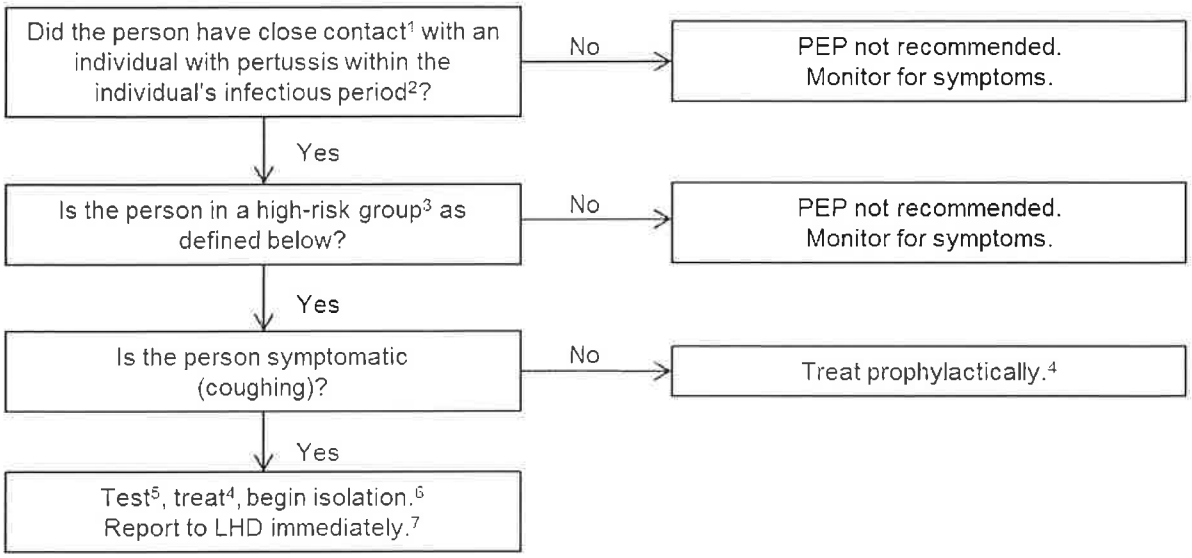
[4]Testing should only be conducted on symptomatic persons. Polymerase chain reaction (PCR) is most sensitive if the specimen is obtained within the first 21 days after cough onset. Culture is most sensitive if the specimen is obtained within the first 14 days after cough onset. If feasible, specimens should be collected for both PCR and culture. If specimens for both tests cannot be collected, PCR testing is preferred.

[5]Treat the patient within 21 days of cough onset (or within 42 days of cough onset for infants aged <1 year) with an appropriate antibiotic. A macrolide is the antibiotic of choice for treatment and prophylaxis of pertussis. Treat regardless of vaccination status.

[6]Exclude patients from work, school or other public contact until at least 5 days of appropriate antibiotic treatment have been completed or until 21 days after onset of cough if appropriate antibiotic treatment is not taken.

[7]Your Local Health Department (LHD) will assist with isolation and contact management. Note that pertussis is a Category 1 reportable disease.

Appendix C – Algorithm II: Clinical Guidelines for Management of Contacts of an Individual with Pertussis



[1]**Close contact** includes:

- Direct face-to-face contact for a period of time (duration not defined)
- Shared confined space in close proximity for a prolonged period of time, such as ≥1 hour
- Direct contact with respiratory, oral, or nasal secretions (e.g., an explosive cough or sneeze in the face). Note: Droplet precautions apply only if the suspected exposure occurred within a three-foot radius.
- Contact in a setting with known pertussis transmission (e.g., two or more cases in same classroom or sports team).

[2]The infectious period is defined as 1 week before cough onset to 21 days after cough onset if untreated or 5 days after initiation of appropriate antibiotic therapy. Infants aged <1 year with pertussis remain infectious for longer periods (up to 42 days from cough onset) if untreated.

[3]**High-risk groups** include:

A. Household contacts
B. Infants aged <1 year
C. Pregnant women in their third trimester of pregnancy
D. Individuals with pre-existing health conditions that may be exacerbated by a pertussis infection (e.g., immunocompromised individuals)
E. Individuals who have close contact with anyone in groups B, C or D above.

[4]Prophylactically treat patient with an appropriate antibiotic if within 21 days of last contact with a case. If the person is symptomatic, treat with an appropriate antibiotic if within 21 days of cough onset or within 42 days of cough onset for infants aged <1 year. A macrolide is the antibiotic of choice for treatment and prophylaxis of pertussis. Treat regardless of vaccination status.

[5]Testing should only be conducted on symptomatic persons. Polymerase chain reaction (PCR) is most sensitive if the specimen is obtained within the first 21 days after cough onset. Culture is most sensitive if the specimen is obtained within the first 14 days after cough onset. If feasible, specimens should be collected for both PCR and culture. If specimens for both tests cannot be collected, PCR testing is preferred.

[6]Exclude patients from work, school or other public contact until at least 5 days of appropriate antibiotic treatment have been completed or until 21 days after onset of cough if appropriate antibiotic treatment is not taken.

[7]Your Local Health Department (LHD) will assist with isolation and contact management. Note that pertussis is a Category 1 reportable disease.

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