

# Pertussis

## Summary

Pertussis, or whooping cough, is a communicable respiratory disease which can cause severe illness, complications and even death, particularly in infants >6 months of age. Neither infection nor vaccination confer lifelong immunity. Adolescents and adults with mild or atypical disease can transmit pertussis to infants, young children, and other susceptible persons. Pertussis can be prevented and controlled with vaccinations, early recognition of signs and symptoms of illness, prompt diagnosis, treatment of cases, and chemoprophylaxis of select close contacts.

## Agent

The bacterium *Bordetella pertussis* is a fastidious Gram-negative bacillus. Several other *Bordetella* species, including, *B. parapertussis* (see appendix D below for recommendations), *B. holmesii* and *B. bronchiseptica*, are also occasionally associated with respiratory disease in humans.

## Transmission

Reservoir:

Humans.

Mode of transmission:

Pertussis is transmitted person to person by direct contact with respiratory secretions or via respiratory droplets produced from coughing, sneezing, or talking face-to-face with infectious individuals.

Period of communicability:

Pertussis is highly contagious. Persons with pertussis are infectious from the beginning of the catarrhal stage through the third week (21 days) of cough or until five days after the start of appropriate antimicrobial therapy. Factors affecting the length of communicability include age, vaccination status, previous pertussis infection, and the timing of appropriate antimicrobial therapy.

## Clinical Disease

Incubation period:

Usually 7-10 days with a range of 5-21 days.

Illness:

Classic pertussis is characterized by spasms of severe coughing (paroxysms) lasting from 6-10 weeks. Pertussis should be suspected in anyone with a paroxysmal cough or a cough that lasts for more than two weeks, regardless of other symptoms. Pertussis classically progresses through three stages though not all cases have a classic presentation:

1. Catarrhal (approximately 1-2 weeks): Rhinorrhea, no or low-grade fever, malaise, decreased appetite, and intermittent non-productive cough.
2. Paroxysmal (approximately 1-6 weeks which may extend to 10 weeks): Spasms of cough ending with a gasp, whoop or vomiting (post-tussive emesis). Infants, however, may lack paroxysmal cough and instead may present with poor feeding, gagging, apnea and/or

cyanosis. Adolescents and adults may have prolonged cough with spasms without whoop or post-tussive emesis.

3. Convalescent (approximately 2-3 or more weeks): Gradual resolution of paroxysmal coughing.

Disease is most severe in infants younger than 6 months of life particularly in preterm and unimmunized infants. Infants may not have a typical presentation of illness.

Additionally, infants are at the highest risk for complications, including pneumonia, seizures, encephalopathy, and death. Other less serious complications include otitis media, anorexia and dehydration. Infection from *B. parapertussis* resembles whooping cough, although the illness may be milder. Differentiation between pertussis and parapertussis is based on isolation of the bacteria in culture or through polymerase chain reaction (PCR) identification. Co-infections of *B. pertussis* with *B. parapertussis*, *B. holmesii* or *B. bronchiseptica* species have been reported. Acellular pertussis vaccine is only effective in preventing *B. pertussis*.

## Laboratory Diagnosis

Laboratory methods may differ depending on individual laboratory capabilities. Pertussis testing at New Mexico State Laboratory Division (SLD) is not free. There is a charge for pertussis tests performed at SLD except in cases where the submitter is a NMDOH public health office or when prior arrangements through the Emergency Response Division (ERD) have been made.

### Laboratory testing at SLD:

- PCR assay performed on a nasopharyngeal (NP) sample obtained via NP swab is the confirmatory diagnostic test that is currently used by SLD in the vast majority of cases. Healthcare providers considering pertussis testing who choose to have their clinical specimens tested at SLD should consult the SLD website at: <https://nmhealth.org/about/sld/> for details of proper specimen handling and submission as well as charges that will apply. PCR testing is the most sensitive and specific test available for pertussis diagnosis and is the most common diagnostic method. PCR may detect *Bordetella* DNA up to 3-4 weeks post cough onset and has been known to detect DNA even shortly after starting antibiotics. PCR should only be performed on patients exhibiting a cough illness since false positive results may occur with this method in those without a cough.
- Despite the widespread use and superior sensitivity of PCR, bacterial culture for pertussis is still considered the diagnostic 'gold standard' and plays an important role in confirming the diagnosis, particularly during outbreaks. Culture is available through SLD on a limited basis as part of Enhanced Pertussis Surveillance (EPS). Culture specimen collection and submission to SLD should be coordinated with the ERD pertussis epidemiologist and the SLD General Microbiology Supervisor. Culture specimens require special collection kits, culture plates, and a monitored incubator. (Contact ERD at 505-827-0006 for guidance).
- Collection/handling of specimens for SLD: Proper specimen collection and handling is imperative. Only use materials approved by SLD when submitting a specimen for testing. Collection kits and methods for PCR and culture specimens are NOT the same. (For details, see specific specimen collection instructions in Appendix A). Specimens collected during the catarrhal or early paroxysmal stage of illness have the highest yield for PCR and culture. After two weeks of cough, the yield on PCR and culture decreases significantly.

### Laboratory testing at Commercial or Reference Laboratories:

- PCR or culture may be performed for diagnostic purposes.
- Direct fluorescent antibody (DFA) tests may provide preliminary evidence of infection. However, a high proportion of false-positive and false-negative results occur with DFA, hence it is no longer recommended. Results should be interpreted with caution. PCR or culture confirmation should be performed on patients who are positive by DFA.
- Serology tests (e.g., IgA, IgM and IgG antibody tests) are available in commercial laboratories. These tests, however, have not been validated or standardized. They are not currently being recommended for diagnostic purposes. For updates on validation of commercial assays visit: <https://www.cdc.gov/pertussis/clinical/diagnostic-testing/diagnosis-confirmation.html>
- Collection/handling of specimens: Check with the laboratory that will be performing testing to assure that specimens are being collected, packaged and shipped in accordance with the laboratory's specifications.

## Treatment

- *Bordetella* genus results from SLD will be available prior to species results. Investigations should begin immediately to identify high-risk susceptible individuals. Treatment and prophylaxis will generally be delayed until species results are available. However, treatment and/or prophylaxis may be indicated prior to speciation in some situations (e.g., young infant, pregnant woman in the 3<sup>rd</sup> trimester, immunosuppressed person). Those decisions will be made on a case-by-case basis.
- Confirmed, probable and PCR positive suspect cases (refer to case definitions below) of pertussis should be treated with an antimicrobial agent. The treatment and chemoprophylaxis regimens for pertussis are the same (as shown in Appendix B) Treat persons aged greater than one year of age within three weeks of cough onset and infants aged one year or less within six weeks of cough onset. Antimicrobials given during the catarrhal stage may reduce duration and severity of signs and symptoms. Antimicrobials given during the paroxysmal stage may have no effect on the course of illness but are recommended to limit transmission to others. Initiating treatment more than three weeks after onset of cough in those greater than one year old is unlikely to be beneficial but may be considered in situations where there is ongoing contact with an infant or a pregnant woman in the third trimester.
- Treatment of PCR negative suspect cases (refer to case definitions below) of pertussis may be indicated based on clinical and epidemiologic information related to the case. Consult with the Epidemiology and Response Division (505-827-0006) for guidance.
- Infantile hypertrophic pyloric stenosis (IHPS) has been reported in neonates following the use of erythromycin (MMWR 1999; 48:1117-1120). IHPS is hypertrophy of the pyloric muscle that usually results in non-bilious projectile vomiting. Although the risk of IHPS is likely to be low, azithromycin is recommended for infants less than one month old. If azithromycin is not available and erythromycin is used, the health care provider should counsel parents about possible risks of IHPS.
- If a person is allergic to macrolides, has a pre-existing condition that precludes the use of macrolides (see Appendix B), or cannot otherwise tolerate them, trimethoprim-sulfamethoxazole (TMP-SMZ) is an effective alternative. TMP-SMZ is contraindicated for infants less than two months or for pregnant women and nursing mothers. See Appendix C for specific information for treating with azithromycin.

## Surveillance

### Case Definition:

*Clinical Case Definition* - In the absence of a more likely diagnosis, a cough illness lasting  $\geq$  2 weeks with at least one of the following: paroxysms of coughing, inspiratory "whoop," post-tussive vomiting, or apnea, with or without cyanosis (for infants less than 1 year only).

#### *Confirmed* -

- An acute cough illness of any duration, with isolation of *B. pertussis* from a clinical specimen; or
- A case that meets the clinical case definition and is confirmed by PCR; or
- A case that meets the clinical definition and epidemiologically linked with a laboratory-confirmed case.

#### *Probable* –

- A case that meets the clinical case definition, is not laboratory-confirmed by culture or PCR (this includes if testing not done or testing negative) and is not epidemiologically linked directly to a laboratory confirmed case.
- An acute cough illness of any duration with at least one clinically-relevant pertussis symptom and confirmation by PCR (Infants < 1 year only)

#### *Suspect* -

- A PCR-positive case exhibiting a cough illness who does not meet the clinical case definition for pertussis; or
- Any case with an equivocal PCR, positive smear DFA, or positive serology result exhibiting a cough illness who does not meet the clinical case definition for pertussis; or
- A contact to a confirmed or probable case exhibiting a cough illness but who does not meet the clinical case definition for pertussis.

### Reporting:

Report all confirmed, probable and suspect cases of pertussis immediately (24/7/365) to the Epidemiology and Response Division (ERD) at 505-827-0006. Required information includes: patient's name, age, sex, race, ethnicity, home address, home phone number, occupation, and healthcare provider. Enter case into New Mexico-Electronic Disease Surveillance System (NM-EDSS) or Fax (505-827-0013) information as soon as it is available.

### Case Investigation:

Use the Pertussis Investigation Form to complete the investigation, all fields within this form are considered to be required fields. Enter information collected during investigation into NM-EDSS per established procedures.

## Control Measures

### 1. Case management:

- 1.1. Isolation: Confirmed, probable, or PCR-positive suspect cases of pertussis should remain in isolation (household contact only) until five days of appropriate antimicrobial therapy have been completed, except when the non-infant case has been coughing for >3 weeks or the infant case has been coughing for >6 weeks.

- 1.1.a For hospitalized patients, droplet precautions should be used until five days of appropriate antibiotic therapy has been completed.
- 1.2. Prophylaxis: Not applicable.
- 1.3. Surveillance activities for pertussis evaluation:
  - 1.3.a Interview case using pertussis case report form and enter information into NM-EDSS.
  - 1.3.b Identify high-risk close contacts and, if asymptomatic, assure prophylaxis as indicated, or refer to healthcare provider (see below).
  - 1.3.c Test, isolate and treat symptomatic contacts presumptively if pertussis is a likely diagnosis and determine if those contacts meet pertussis clinical case definition.
  - 1.3.d Contact the institution (e.g., child care facility, school, or workplace) where case and symptomatic contacts are located.
2. Contact management
  - 2.1. Close contact is defined as follows:
    - 2.1.a Direct contact with respiratory, oral, or nasal secretions (e.g., cough or sneeze in the face, kissing, mouth-to-mouth resuscitation, performing a full examination of the nose and throat)
    - 2.1.b Shared confined space in close proximity for a minimum of  $\geq$  one consecutive hour with a symptomatic case
  - 2.2. High-risk close contacts are:
    - 2.2.a Infants (<1-year-old).
    - 2.2.b Pregnant women in the third trimester of pregnancy
    - 2.2.c Individuals considered to be immunocompromised/immunosuppressed
    - 2.2.d Household members. Household members are defined as persons living in the primary household of a case >50% of the time during the case's infectious period as measured in days. The days need not be consecutive. A relative or friend who spent <50% of the infectious period (measured in days) with the case would not be considered a household member.
  - 2.3. Isolation: Symptomatic (i.e., those with cough illness) close contacts of confirmed, probable or PCR- positive suspect cases of pertussis should remain in isolation until five days of appropriate antibiotic therapy have been completed or negative PCR results and clinical findings suggest an alternative diagnosis.
  - 2.4. Prophylaxis:
    - 2.4.a. The following close contacts of confirmed, probable, and PCR positive suspect cases of pertussis require chemoprophylaxis, regardless of their vaccination status:
      - Infants (<1year old).
      - Pregnant women in the third trimester of pregnancy.
      - Household members.

- All those attending or working in a setting (e.g., same infant room, same classroom, same neonatal intensive care unit (NICU) of a case IF there is an infant or a woman in the third trimester of pregnancy in the setting).
  - Individuals with pre-existing health conditions or severe immunocompromise that may predispose them to complications associated with pertussis (e.g., pulmonary conditions such as moderate to severe asthma, chronic obstructive pulmonary disease [COPD], lung cancer, cystic fibrosis, significant underlying cardiopulmonary disease, or significant immunocompromise such as organ transplant recipients, people receiving therapies that suppress the immune system).
  - Health care providers who provide direct care for infants or pregnant women (e.g., NICU workers, OB/GYNs, pediatricians, family practice physicians, nurse practitioners and physician assistants, nurses, medical assistants, emergency room, EMS personnel)
  - Other contacts (or, in rare cases, high-risk contacts of contacts) at the discretion of ERD (e.g., close contacts who are vaccine exemptors, women in the third trimester who are contacts of contacts, infant contacts of contacts, medically fragile contacts of contacts).
- 2.4.b. Chemoprophylaxis is not recommended for other close contacts who do not meet any of the criteria in 3.3.a above unless special circumstances are identified.
- Prophylaxis should be recommended for the contacts listed above who have been exposed within 21 days (one maximum incubation period).
- Data supporting the use of antimicrobials to prevent secondary cases are weak. Over-reliance on antimicrobials for pertussis post-exposure prophylaxis may provide a false sense of security. Prophylaxis of contacts does not replace the need for ongoing surveillance. Monitor all settings where confirmed and probable cases have been identified for additional cases for 21 days after last contact with a case.
- 2.4.c. If a symptomatic contact is identified, that person needs to be evaluated for pertussis. If s/he meets the pertussis case definition, a case report form needs to be completed, the case needs to be entered in NM-EDSS, high-risk and household contacts need to be identified, evaluated, and receive prophylaxis as indicated. Ongoing surveillance of the household for secondary cases is necessary for a minimum of 21 days following the case's last day of antimicrobials or 21 days after the last day the case was believed to be infectious in situations where antibiotics were not prescribed.
- 2.4.d. Assess the vaccination status of all contacts. Exposed children less than seven years of age who have received their third dose of DTaP six months or more before exposure to pertussis should be given a 4<sup>th</sup> dose. Children less than seven years of age who received all four primary doses before their fourth birthday should receive a fifth (booster) dose of DTaP before entering school. Persons 7-9 years of age who have not been fully vaccinated against pertussis should receive Tdap. Those 10 years of age or older who have not received Tdap should get it. There is no need to observe any minimum interval between doses of Td and Tdap. Pregnant women should be vaccinated at each pregnancy and ideally between 27 and 36 weeks gestation. If not administered during pregnancy, Tdap should be administered immediately postpartum. Also, all adults should have documentation

of one dose of Tdap. If adults have not received one dose of Tdap, they should receive it as soon as possible, particularly those who will have contact with infants.

### 3. Prevention

- 3.1. Immunization: There are currently two licensed pertussis vaccines in the US. They are acellular vaccines combined with diphtheria and tetanus toxoids. DTaP is recommended for pediatric use (children under seven years old). Tdap is the adolescent & adult formulation.
- 3.2. DTaP is the recommended vaccine for use in infants and children up to 7 years of age. The vaccine efficacy for disease prevention is 70-90% after completion of a four-dose series. For more information about vaccines, refer to the NMDOH Immunization Program website at: <http://immunizenm.org>.

## Management of Pertussis in Child Care Centers

1. When a case of pertussis is reported in an attendee or staff member at a child care facility, the following recommendations apply:
  - 1.1. Consult with the ERD at (505) 827-0006 (24/7/365) regarding the case.
  - 1.2. Notify the child care director that a case has occurred and provide education about disease transmission and prevention.
  - 1.3. Conduct active surveillance at the facility for one incubation period (21 days).
  - 1.4. If symptomatic contacts are identified, refer them to a health care provider or, if they have no access to health care services, refer them to their local public health office for consultation and potential evaluation. If a symptomatic contact meets the clinical case definition they need to be entered into NM\_EDDS, consider laboratory testing for pertussis, identify their high-risk contacts for prophylaxis, and isolate the case until five days of an appropriate antibiotic have been completed.
  - 1.5. Any confirmed, probable or PCR-positive suspect cases of pertussis and any symptomatic contacts should be excluded until completion of five days of appropriate antibiotics.
  - 1.6. Consider excluding the following individuals for 21 days after their last exposure to a case: asymptomatic high-risk contacts who refuse antimicrobials; vaccine exemptors; contacts who are not up to date with pertussis vaccination. These situations will be considered on a case-by-case basis.
2. Consult with ERD if the school requests assistance sending a letter of notification and educational fact sheet to attendees' families and/or school staffs.
3. Assess the vaccination status of all contacts and attendees in the same setting. Exposed children less than seven years of age who have received their third dose of DTaP six months or more before exposure to pertussis should be given a 4<sup>th</sup> dose. Children less than seven years of age who received all four primary doses before their fourth birthday should receive a fifth (booster) dose of DTaP before entering school. Persons 7-9 years of age who have not been fully vaccinated against pertussis should receive Tdap. Those 10 years of age or older who have not received Tdap should get it. There is no need to observe any minimum interval between doses of Td and Tdap. Pregnant women should be vaccinated at each pregnancy and ideally between 27 and 36 weeks gestation. If not administered during pregnancy, Tdap should be administered immediately postpartum. Also, all adults should have documentation of one

dose of Tdap. If adults have not received one dose of Tdap, they should receive it as soon as possible, particularly those who will have contact with infants and all health care personnel.

4. If an outbreak is identified or suspected, consult with ERD and the child care owner/operator.
5. Focus prophylaxis efforts on high-risk and close contacts.

## **Management of Pertussis in a School**

1. When a case of pertussis is reported in a school, regardless of whether the school is private or public, contact the school nurse and provide the following recommendations:
  - 1.1. Consult with the ERD regarding the case.
  - 1.2. Inform the principal, teacher(s), and appropriate staff.
  - 1.3. Elicit the school nurses' assistance in identifying high-risk close contacts of the case, vaccine exemptors, and those not up to date with pertussis vaccination.
  - 1.4. Conduct active surveillance at the facility for one incubation period (21 days)..
  - 1.5. If symptomatic contacts are identified, refer them to a health care provider or, if they have no access to health care services, refer them to their local public health office for consultation and possible evaluation. If a symptomatic contact meets the clinical case definition, consider laboratory testing for pertussis, identify their high-risk contacts for prophylaxis, and isolate the case until five days of an appropriate antibiotic have been completed.
  - 1.6. Any confirmed, probable, or PCR-positive suspect cases of pertussis and any symptomatic contacts should be excluded until completion of five days of appropriate antibiotics.
  - 1.7. Consider excluding the following individuals for 21 days after their last exposure to a case: asymptomatic high-risk contacts that refuse antimicrobials; vaccine exemptors; or contacts that are not up to date with pertussis vaccination. These situations will be considered on a case-by-case basis.
  - 1.8. Provide education to staff, students, and parents about the clinical presentation, disease transmission, incubation period, prophylaxis and/or treatment.
2. Consult with ERD if the school requests assistance sending a letter of notification and educational fact sheet to attendees' families and/or school staffs.
3. If a case attends several classes or group activities at the school, then the school nurse should identify high-risk contacts for prophylaxis in every setting where contact occurred with the case and should report any student with paroxysmal cough of any duration or any student with non-paroxysmal cough illness of  $\geq 7$  days duration.
4. Assess the vaccination status of all contacts and students in the same setting. Exposed children less than seven years of age who have received their third dose of DTaP six months or more before exposure to pertussis should be given a 4<sup>th</sup> dose. Children less than seven years of age who received all four primary doses before their fourth birthday should receive a fifth (booster) dose of DTaP before entering school. Persons 7-9 years of age who have not been fully vaccinated against pertussis should receive Tdap. Those 10 years of age or older who have not received Tdap should get it. There is no need to observe any minimum interval between doses of Td and Tdap. Pregnant women should be vaccinated at each pregnancy and ideally between 27 and 36 weeks gestation. If not administered during pregnancy, Tdap should be administered



immediately postpartum. Also, all adults should have documentation of one dose of Tdap. If adults have not received one dose of Tdap, they should receive it as soon as possible, particularly those who will have contact with infants and health care personnel.

5. If an outbreak is identified or suspected, consult with ERD and school officials.
6. Focus prophylaxis efforts on high-risk and close contacts.

## Appendices

- Appendix A. New Mexico Department of Health - Scientific Laboratory Division (SLD), *Bordetella pertussis* (Whooping cough) Specimen Collection Procedure for PCR Testing
- Appendix B. Pertussis Treatment Recommendations
- Appendix C. FDA Azithromycin Warning
- Appendix D. Parapertussis Case Management

## References

American Academy of Pediatrics. In: Kimberlin, DW, et al eds. Red Book: 2018 Report of the Committee on Infectious Diseases. 31st ed. Itasca, IL: American Academy of Pediatrics; 2018.

Centers for Disease Control and Prevention, National Immunization Program. Guidelines for the control of pertussis outbreaks. Available at: <https://www.cdc.gov/pertussis/php.html>

Heymann DL, ed. Control of Communicable Diseases Manual. 20<sup>th</sup> ed. Washington, DC: American Public Health Association; 2015.

Pertussis. In: Centers for Disease Control and Prevention. Epidemiology and prevention of vaccine-preventable diseases. 13<sup>th</sup> ed. Washington, D.C.: Public Health Foundation; 2015. Available at: <http://www.cdc.gov/vaccines>

Recommended Antimicrobial Agents for Treatment and Postexposure Prophylaxis of Pertussis 2005 CDC Guidelines in Morbidity and Mortality Weekly Report (MMWR). Dec. 9, 2005/Vol. 54/No. RR-14.

FDA Drug Safety Communication: Azithromycin (Zithromax or Zmax) and the risk of potentially fatal heart rhythms, March 12, 2013. Available at: <https://www.fda.gov/ForConsumers/ConsumerUpdates/ucm343281.htm>

## Appendix A

### New Mexico Department of Health - Scientific Laboratory Division (SLD)

#### *Bordetella pertussis* (Whooping cough) Specimen Collection Procedure for PCR Testing

Healthcare providers considering pertussis testing through SLD directly should call the infectious disease epidemiology on-call service (available 24/7/365 at 505-827-0006) to expedite testing. Tests approved by an on-call epidemiologist will be processed by SLD at no cost.

If the test ordered has been pre-approved by the ERD on-call service, the submitter must write “pre-approved” in the upper right-hand corner of the SLD General Clinical Request Form.

Kit includes: This instruction sheet, SLD’s General Clinical Request Form, nasopharyngeal (NP) swab in plastic tube for real-time PCR, plastic bag. This kit may be kept at room temperature as there are no temperature requirements for the uninoculated swab.

**Wear gloves, a mask and eye protection while collecting specimens to minimize risk of exposure to respiratory secretions.**

#### A. Obtain a nasopharyngeal specimen as follows:

- Immobilize the patient’s head.
- Gently insert a thin Rayon/Nylon NP swab into a nostril until the posterior nasopharynx is reached.
- Leave the swab in place for up to 10 seconds. This procedure may induce coughing and tearing.
- Remove and repeat procedure on the opposite nostril. It is important to obtain sample from both nostrils, as in some instances one nostril may be negative whereas the other is positive for pertussis.
- If resistance is encountered during insertion of the swab, remove it and attempt insertion on the opposite nostril.
- Remove the swab slowly.



- Immediately replace the swab back into the plastic tube.
- Label the swab’s plastic tube with the patient’s name and DOB. A preprinted label would be preferable.

#### B. Completely fill out SLD’s General Clinical Request Form with:

- Submitter name and address
- Patient name
- Sex
- DOB
- Clinician name and phone number
- Date/time collected
- Indicate specimen source (Nasopharyngeal swab)
- Indicate test request (Pertussis, (*Bordetella* spp.))

**C. Place the properly labeled 1) plastic tube with inoculated swab and 2) completed General Clinical Request Form into the plastic bag provided. Send immediately to SLD.**

- The inoculated swab can be refrigerated, but if there will be a delay in transport of more than two hours, please place the bag in the freezer.
- When ready to transport, please send to SLD on an ice pack.

**D. Rejections**

- Samples not received on an ice pack will be rejected.
- Please note that the PCR is able to detect and evaluate specimen quality. SLD will reject specimens where the swab is insufficiently inoculated. Please ensure that your staff follows the instructions described above.
- SLD will only accept swabs that are nasopharyngeal (NP) swabs made of synthetic materials and in dry plastic containers. Swabs made of calcium alginate or cotton are not acceptable. Swabs in paper sleeves will also be rejected. See pictures above for two appropriate types of NP swabs.
- SLD will reject swabs collected as Nasal swabs as opposed to Nasopharyngeal swabs due to the increased chance of obtaining a false negative from a nasal swab.

**E. Kits**

- The kit can be ordered as usual through SLD's Specimen Receiving section by faxing Specimen Receiving at 505-383-9062 (ATTN: Kit Prep on the fax sheet).
- Questions on *Bordetella* testing can be directed to the Molecular Biology Section – 505-383-9130 or 383-9132.

## Appendix B

### Dosing Guidelines for Treatment and Chemoprophylaxis of Pertussis\*

**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*.

\* Taken from Recommended Antimicrobial Agents for Treatment and Postexposure Prophylaxis of Pertussis 2005 CDC Guidelines. MMWR Dec. 9, 2005/Vol. 54/No. RR-14

- Duration of therapy varies by agent.
- Azithromycin and clarithromycin are better tolerated than erythromycin. Erythromycin frequently causes gastrointestinal disturbances (anorexia, nausea, vomiting, and diarrhea).
- Assess patient medication allergies and potential for drug interactions before selecting agent. Any questions should be discussed with the patient’s health care provider or ERD.
- For pregnant woman, the antimicrobial of choice is erythromycin or azithromycin. Both erythromycin and azithromycin are categorized as pregnancy Class B. There is limited evidence regarding macrolide safety during pregnancy. However, erythromycin and azithromycin have been widely used during pregnancy without evidence of adverse birth outcomes. Clarithromycin should not be used in pregnant women except in clinical circumstances where no alternative therapy is appropriate, and the potential benefit justifies the potential risk to the fetus.
- TMP-SMZ should not be administered to pregnant women or nursing mothers.
- Ampicillin, amoxicillin, and cephalosporins are not suitable for the treatment or chemoprophylaxis of pertussis. In addition, due to their potential harmful side effects in children, tetracyclines, and flouroquinolones are also not recommended.
- To convert from pounds (lbs) to kilograms (kg) – Divide weight in lbs by 2.2 (e.g. 25 lbs = 25/2.2= 11.4 kg).

## Appendix C

### FDA Azithromycin Warning

Azithromycin remains one of the recommended drugs for treatment and chemoprophylaxis of pertussis. However, newer studies suggest an alternative drug should be used in pertussis cases or contacts that have cardiovascular disease including:

- Patients with known prolongation of the QT interval, a history of torsades de pointes, congenital long QT syndrome, bradyarrhythmias, or uncompensated heart failure.
- Patients on drugs known to prolong the QT interval.
- Patients with ongoing proarrhythmic conditions such as uncorrected hypokalemia or hypomagnesemia, clinically significant bradycardia, and in patients receiving Class IA (quinidine, procainamide) or Class III (dofetilide, amiodarone, sotalol) antiarrhythmic agents.

Elderly patients and patients with cardiac disease may be more susceptible to the effects of arrhythmogenic drugs on the QT interval. Alternatives for treatment/chemoprophylaxis for pertussis include other drugs in the same class as azithromycin (erythromycin or clarithromycin) or trimethoprim-sulfamethoxazole.

Practitioners should continue to be vigilant in diagnosis and treatment of pertussis as outbreaks continue to occur throughout the US. Provisional data from 2012 report more than 41,000 cases of pertussis, the most since 1955. Practitioners should remember that treatment can shorten the duration of illness and lessen its severity when initiated early in the course, which is potentially feasible when given in a household contact of someone with pertussis. As in all drug prescribing, discussion of risk/benefit assessment should occur.

Post-exposure prophylaxis focuses on preventing disease among those at greatest risk for having serious complications from pertussis or spreading the disease to those at greatest risk.

#### Background

The US Food and Drug Administration (FDA) warned on March 12, 2013 that the antibiotic azithromycin (Zithromax®) can cause abnormal changes in the electrical activity of the heart that may lead to a potentially fatal irregular heart rhythm in some patients.

Patients at particular risk for developing this condition include those with known risk factors such as:

- Existing QT interval prolongation, a history of torsades de pointes, congenital long QT syndrome, bradyarrhythmias, or uncompensated heart failure
- Low blood levels of potassium or magnesium
- A slower than normal heart rate
- Use of certain drugs used to treat abnormal heart rhythms, or arrhythmias

This warning is a result of FDA's review of a study by medical researchers as well as another study by a manufacturer of the drug that assessed the potential for azithromycin to cause abnormal changes in the electrical activity of the heart.

The azithromycin drug labels have been updated to strengthen the *Warnings and Precautions* section with information related to the risk of QT interval prolongation and torsades de pointes, a specific, rare heart rhythm abnormality. Information has also been added regarding the results of a clinical QT study which showed that azithromycin can prolong the QT interval.

### General Information for Healthcare Professionals

Health care professionals should consider the risk of torsades de pointes and fatal heart rhythms with azithromycin when considering treatment options for patients who are already at risk for cardiovascular events.

FDA notes that the potential risk of QT prolongation with azithromycin should be placed in appropriate context when choosing an antibacterial drug. Alternative drugs in the macrolide class and non-macrolides, such as the fluoroquinolones, also have the potential for QT prolongation or other significant side effects that should be considered when choosing an antibacterial drug.

### Information for Patients

- Do not stop taking azithromycin without talking to your health care professional.
- Discuss any questions or concerns about azithromycin or other antibacterial drugs with your health care professional.
- Seek immediate care if you experience an irregular heartbeat, shortness of breath, dizziness, or fainting while taking azithromycin.
- Report any side effects you experience to your health care professional and the [FDA MedWatch program](#).

## Appendix D

### Parapertussis and holmesii Case Management

Taken from Minnesota Department of Health's website:

(<http://www.health.state.mn.us/divs/idepc/diseases/pertussis/parapertussis.html>)

Parapertussis and holmesii are diseases that affects the lungs. They are similar to pertussis (whooping cough) but less severe.

The symptoms of parapertussis and holmesii can be similar to a cold: sneezing, a runny nose, possibly low-grade fever, and a cough. After a week or two, the cough may become more severe and include:

- A cough that occurs in sudden, uncontrollable bursts.
- High-pitched whooping sounds when breathing in after a coughing episode.
- Vomiting after a coughing spell.

Persons with parapertussis or holmesii do not need to stay home from school, work, or other activities because the illness is relatively mild. However, it is important to still cover your cough and wash your hands to prevent the spread of germs to others.

These diseases can be treated with the same antibiotics as pertussis, but treatment may not cure the symptoms.

Preventive treatment is not generally recommended for contacts of people with parapertussis or holmesii. Preventive treatment may be considered for close contacts who are at a higher risk for more severe disease, including infants less than 6 months of age and immunocompromised people.

- Avoid close contact with others who are coughing or otherwise ill.
- Wash your hands often.
- Cover your cough and sneezes with a tissue, or cough and sneeze into your sleeve.

See Whooping Cough (Pertussis) Fact Sheets ([English](#)) ([Spanish](#)).