Pertussis

BASIC EPIDEMIOLOGY

Infectious Agent
Bordetella pertussis (*B. pertussis*), a fastidious Gram-negative bacillus

Transmission
Transmitted from person to person through direct contact with respiratory secretions, most commonly through direct contact with airborne droplets from infectious individuals

Incubation Period
Average of 7-10 days (range 4-21 days)

Communicability
Pertussis is highly contagious. Persons with pertussis are most infectious during the catarrhal period and for 21 days after cough onset. Persons with pertussis are no longer contagious after appropriate antibiotic treatment has been completed, usually 5 days.

Clinical Illness
The clinical course of illness is divided into the following three stages:

- The **catarrhal stage** is characterized by the onset of a runny nose, sneezing, low-grade fever, and a slight cough. The cough gradually becomes more severe and after 1-2 weeks, the next stage develops.
- The **paroxysmal stage** is characterized by coughing fits (paroxysms), which may be followed by an inspiratory whooping sound, apnea, or vomiting. This usually lasts 1-6weeks but may continue for 10 weeks.
- In the **convalescent stage**, there is a gradual resolution of the paroxysmal coughing. The coughing may resolve after a few weeks but may continue for months.

Regardless of vaccination history, pertussis can occur at any age. In infants less than 12 months of age, apnea may be the initial or most important symptom. An indication to the diagnosis **in infants only** is an elevated white blood count (over 15,000/mm3). In infants, pertussis symptoms can include apnea, pneumonia, pulmonary hypertension, seizures, and encephalopathy. Pertussis can cause serious complications and even death in infants. Among older children, adolescents, and adults, pertussis symptoms are usually milder.

Other *Bordetella* infections
B. parapertussis is a less common, non-reportable infection requiring no public health action. Parapertussis symptoms are similar but milder than pertussis, and serious complications are rare. *B. pertussis* infections provide little cross-protection against subsequent infection with the *B. parapertussis* and vice versa; pertussis vaccine does not prevent parapertussis. *Bordetella holmesii* has been associated most often with sepsis in patients with underlying conditions.

B. bronchiseptica is rare in humans. We recommend that reports of parapertussis, holmesii and bronchiseptica infection not be investigated further, except in certain outbreak instances. We do not recommend chemoprophylaxis for close contacts to be given. The decision to treat patients with these non-pertussis *Bordetella* infections may be left to the clinician's judgment.

DEFINITIONS

Clinical Case Definition
A cough illness lasting at least 14 days AND at least one of the following additional symptoms in the absence of a more likely diagnosis:

- Paroxysmal coughing, OR
- Inspiratory "whoop," OR
- Post-tussive vomiting, OR
- Apnea (with or without cyanosis)

Laboratory Criteria for Diagnosis

- Isolation (culture) of *Bordetella pertussis* from a clinical specimen, **OR**
- Positive PCR assay for *Bordetella pertussis*.

Note:

- Because *B. pertussis* can be difficult to culture, a negative culture result does not rule out pertussis.
- Negative PCR results do not require investigation unless reported as a suspected case by a health professional.
- Direct fluorescent antibody (DFA) staining of a patient's specimen and serological laboratory results (pertussis IgA, IgG or IgM) are NOT considered confirmatory for pertussis but should be investigated as soon as possible.

Case Classification

- **Confirmed**: Must meet one of the following criteria:
  - A person with an acute cough illness of any duration who is culture positive, **OR**
  - A person with an acute cough illness of any duration who is PCR positive, **OR**
- **Probable:** A person must meet one of the following criteria (in the absence of a more likely diagnosis):
  - A person with an acute cough illness 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
    - epidemiological linkage to a laboratory confirmed case
      OR
    - A person who meets the clinical case definition

SURVEILLANCE AND CASE INVESTIGATION

Case Investigation
Local and regional health departments should promptly investigate all reports of pertussis. Investigation should include identification and evaluation of close contacts.

All positive lab results should be investigated, even non-confirmatory ones (e.g., DFA, serology results). Priority for investigating lab results should be culture/PCR, DFA, serology. Serology results can be further prioritized into pertussis toxin IgG, toxin/FHA IgG total antibody, IgA results, IgM results, everything else.

Case Investigation Checklist

- ☐ Confirm that laboratory results meet the case definition.
- ☐ Review medical records or speak to an infection preventionist or physician to verify case definition and vaccination status.
    - The Pertussis Investigation Form should be used to record information collected during the investigation.
- ☐ Droplet precautions should be used for confirmed and probable cases until the case has received at least five days of an appropriate antibiotic.
- ☐ Interview patient (or surrogate).
- ☐ Determine vaccination status of the case. Sources of vaccination status that should be checked include:
    - Case (or parent), ImmTrac, school nurse records, primary care provider, etc.
- ☐ Identify close contacts and ensure appropriate prophylaxis is provided as appropriate (see Close Contacts below).
- ☐ Notify school/daycare if the case attended while infectious.
- ☐ In the event of a death, notify EAIDU **immediately**. Copies of the hospital discharge summary, death certificate, and autopsy report should also be faxed to DSHS EAIDU.
    - The Pertussis Death Investigation Form must also be completed and submitted to EAIDU
- ☐ Hospitalized cases should be followed until discharge, especially if the case is an infant.
    - NBS data entry/initial reports can be sent to DSHS prior to discharge.
- ☐ Maternal vaccination history should be obtained for all pertussis cases under one year of age.
- ☐ Secure email, fax, or mail the completed the Pertussis Investigation Form and if applicable, the Pertussis Death Investigation Form to DSHS.
- ☐ All confirmed and probable case investigations must be entered and submitted for notification in the NEDSS Base System (NBS) within 30 days of report. Please refer to the *NBS Data Entry Guidelines* for disease specific entry rules.

Managing Close Contacts

- Close contacts are defined to include immediate family members (those who spend many hours together or sleep under the same roof) and anyone who had direct contact with respiratory secretions.
- Identify all exposed contacts including the following:
    - Household contacts
    - Apart from household contacts, the definition of close contact can vary. The following are options of how to define a close contact:
        - Those within close proximity (2 feet) for 2 hours or longer at any one period of time
        - Those who shared confined space (within ~6 feet) for >1 hour during the communicable period.
        - Healthcare workers caring for a case without wearing a mask.
        - Schoolchildren sitting within ~3 feet of a case (i.e., adjacent seating) can also be included.
- High risk people are those who personally are at high risk of developing severe illness, or those people who will have close contact with people at high risk of severe illness. High risk people include:
    - Infants
    - Women in their third trimester of pregnancy
    - All persons with pre-existing health conditions that may be exacerbated

by a pertussis infection (such as immunocompromised persons or moderate to severe medically-treated asthma)
    - People who routinely come into contact with any of the above are classified as high risk
    - All people in high-risk settings that include infants aged <12 months or women in their third trimester of pregnancy. These include, but are not limited to neonatal intensive care units, childcare settings, and maternity wards.

Prophylaxis Guidelines

- **Not all contacts need prophylaxis**, some may just need to be evaluated for symptoms and educated about pertussis. **High risk contacts should be prophylaxed and household contacts**.
- Antibiotic prophylaxis is recommended if initiated within 21 days of exposure for all household and high risk contacts.
    - Within families, secondary attack rates have been demonstrated to be high, even when household contacts are current with immunizations. Administration of antimicrobial prophylaxis to asymptomatic household contacts within 21 days of onset of cough in the index patient can prevent symptomatic infection.
    - Initiating antibiotic treatment more than 3 weeks after exposure has limited benefit and is not recommended, except for high-risk contacts that may benefit from antibiotic prophylaxis up to 6 weeks after exposure.
    - For more information, see CDC postexposure antimicrobial prophylaxis page: https://www.cdc.gov/pertussis/pep.html.
    - Refer to the table below for antibiotics recommended as treatment and postexposure prophylaxis.
- The Texas Medical Board recently changed its rules (Texas Administrative Code, Title 22, Part 9, Chapter 190, Subchapter B, §190.8) regarding the prescribing of prophylaxis for close contacts to infectious disease. Physicians can now prescribe pertussis antibiotics to contacts of pertussis cases without first medically evaluating the contact.
- Anyone age 11 or older who has not received Tdap should get vaccinated.
- Children who received their third dose of DTaP vaccine 6 months or more before exposure should be given a fourth dose at this time.
- Children who have had at least 4 doses of DTaP should receive a booster dose of DTaP
  unless a dose has been given within the last 3 years or they are 7 years of age or older.
- Close contacts younger than 7 years who are unvaccinated or who have fewer than 4 doses of DTaP vaccine should be vaccinated according to the recommended schedule.
- Exposed children should be observed for 21 days after last contact with the exposed person.
- For health departments that do not maintain their own supply of antibiotics, DSHS has limited quantities of antibiotics available for prophylaxis of high-risk and household contacts that cannot otherwise obtain them.
    - Contact your regional office to obtain antibiotics

The current CDC guidelines for treatment and postexposure prophylaxis of pertussis are summarized in the table below and can also be found at:
http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5414a1.htm.

Recommended Antimicrobial Treatment and Postexposure Prophylaxis for Pertussis, by Age Group

Primary Agents				Alternate Agent*
Age Group	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 to 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 to 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 to 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 4 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*

Treatment
Pertussis infection can be treated through appropriate antibiotic usage as prescribed by a health care provider.

Exclusion
Until completion of 5 days of antibiotic therapy if cough onset is within past 21 days. If more than 21 days have passed since cough onset, no exclusion is necessary.

MANAGING SPECIAL SITUATIONS

Communication Toolkits can be found at https://www.dshs.texas.gov/IDCU/health/vaccine_preventable_diseases/VPD-Resources.aspx and provide examples of letters used to complete the following activities.

Outbreaks

- Three cases of pertussis that overlap in time (cough onsets within 21 days of each other) and place is considered an outbreak in Texas.
- Three or more cases in a household do not count as an outbreak.
- Outbreak names should be requested from the NEDSS office and entered into NBS for each case associated with the outbreak.
- Even in the event of an outbreak, antibiotic prophylaxis is still only recommended for household and high-risk contacts.
- A broader use of PEP may be appropriate in limited closed settings when the number of identified cases is small and when a community-wide outbreak is not ongoing. However, when continued transmission of pertussis is evident, multiple rounds of antibiotics would not be recommended. Rather than repeating a course of antibiotics, you should monitor people exposed to pertussis for onset of pertussis signs and symptoms for 21 days.
- Active screening for symptomatic patients with suspected pertussis can be considered during outbreaks in settings such as schools, daycare centers, and hospitals.
- If an outbreak of pertussis is suspected, notify the regional DSHS office or EAIDU at **(800) 252-8239 or (512) 776-7676**.

Healthcare exposures:

- Any healthcare exposures that involve high-risk contacts (e.g., NICU, OB/GYN offices) should be investigated. High risk individuals should be identified and referred for evaluation and possible PEP.
- If the case is a healthcare worker, the infection control practitioner (ICP) of the affected facility should identify and refer all symptomatic contacts (patients and coworkers) for medical evaluation and presumptive treatment immediately. In addition, chemoprophylaxis should be given to exposed healthcare personnel (HCP) who have not had Tdap; or are likely to expose a neonate or a pregnant woman (even if they have had Tdap).
- In addition, unvaccinated HCW should be given Tdap, regardless of age; and all exposed HCW should be monitored daily for 21 days and treated promptly should symptoms of pertussis ensue.
- The asymptomatic contacts may remain in the workplace if they comply with prophylaxis and lack respiratory symptoms; they should be under surveillance for 21 days past their last known exposure.
- Health care workers should contact the facility ICP if respiratory symptoms develop and not work until pertussis is excluded. If the facility has no ICP, the health department may need to coordinate these activities.

Schools:

- PEP is not recommended by the CDC in school settings.
- School nurses or administration should be made aware of the exposure and should monitor classroom contacts for symptoms.
- Coughing contacts should be referred to their healthcare provider for evaluation.
- If two or more cases are identified in a classroom DSHS recommends sending letters home (from the HD or school) to parents of exposed children.

Daycares:

- If the exposure involves children under one year of age, PEP is recommended. Otherwise follow the instructions for schools.
- Daycares may be required to notify parents in accordance with DFPS licensure.

Infant cases and contacts:

- Infant cases are treated differently than older pertussis cases. Infants are the most vulnerable age group, especially for adverse outcomes, hospitalization and death.
- Additional information is required when investigating infant cases of pertussis.
    - Hospitalized infants must have dates of admission and discharge recorded in NBS. If the investigation is complete, but the child remains hospitalized, please enter the case in NBS and continue to monitor the child's hospital stay until discharge (or death) and then update NBS accordingly.
    - Vaccination status of the mothers of infant cases is also required. Please use the patient interview, hospital records, Immtrac2, and even prenatal care records to determine the mother's pre/perinatal vaccination history.
        - If the mother does not remember, please ask leading questions such as if she received any vaccines while pregnant or if she any received prenatal care.
        - Any information obtained about maternal vaccination should be recorded in NBS.
- Much of pertussis investigation now focuses on preventing adverse effects in infants.
    - Pertussis contacts that are infants, are pregnant, or are household contacts of infants or pregnant women should be prioritized.
    - Post-exposure prophylaxis and appropriate vaccination (if indicated) of these contacts should be done immediately.
- Infants may also have a different clinical picture and to that end, a different case definition is used for infant cases only (see the case definition at the beginning of this chapter).

REPORTING AND DATA ENTRY REQUIREMENTS

Provider, School & Child-Care Facilities, and General Public Reporting Requirements Confirmed, probable and clinically suspected cases are required to be reported **within 1 work day** to the local or regional health department or to DSHS EAIDU at **(800) 252-8239 or (512) 776-7676.**

Local and Regional Reporting and Follow-up Responsibilities
Local and regional health departments should:

- Enter the case into NBS and submit an NBS notification on all **confirmed and probable** cases to DSHS within 30 days of receiving a report of a confirmed case.
    - Please refer to the *NBS Data Entry Guidelines* for disease-specific entry rules.
    - A notification can be sent as soon as the case criteria have been met. Additional information from the investigation may be entered upon completing the investigation.
- Fax, send a secure email, or mail a completed investigation form within 30 days of completing the investigation.
    - **In the event of a death, copies of the hospital discharge summary, death certificate, and autopsy report should also be sent to DSHS EAIDU.**
    - Investigation forms may be faxed to **512-776-7616,** securely emailed to VPDTexas@dshs.texas.gov or mailed to:

Emerging and Acute Infectious Disease Unit
Texas Department of State Health Services
Mail Code: 1960
PO Box 149347
Austin, TX 78714-9347

When an outbreak is investigated, local and regional health departments should:

- Report outbreaks within 24 hours of identification to the regional DSHS office or to EAIDU at (800) 252-8239 or 512-776-7676.
- All outbreaks should be recorded in NBS.
    - Outbreak names must be requested through the NEDSS (NBS) office.

LABORATORY PROCEDURES

Isolation of the organism by culture is ideal; however, it is not readily available. Culture is highly specific, but relatively insensitive. Culture confirmation is recommended for outbreaks. Pertussis culture testing is complicated, so please contact EAIDU for further information during outbreaks. Direct fluorescent antibody (DFA) testing of nasopharyngeal secretions has been shown to have low sensitivity and variable specificity; therefore, it should only be used for screening and not relied upon for laboratory confirmation. DFA is not available from the DSHS Laboratory.

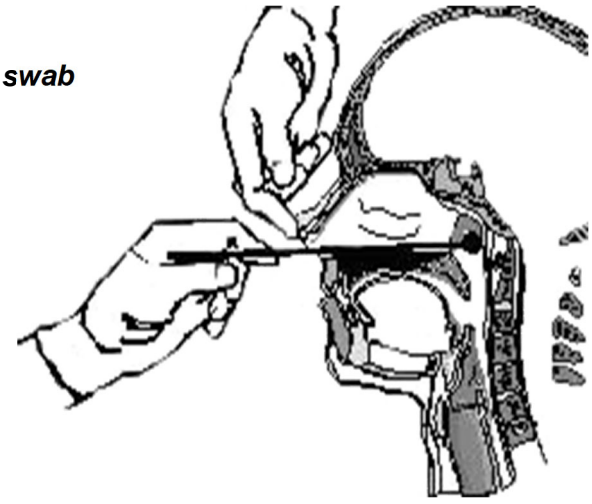
The preferred laboratory test for pertussis is Polymerase Chain Reaction (PCR). PCR testing can be a rapid, sensitive, and specific method for diagnosing pertussis. Pertussis PCR is now widely available at commercial hospitals and laboratories. DSHS performs the testing, usually for a fee.

To obtain pertussis PCR testing kits, contact the DSHS Laboratory at **(512) 776-7661**.

Specimen Collection and Submission

Nasopharyngeal Swab for PCR Testing

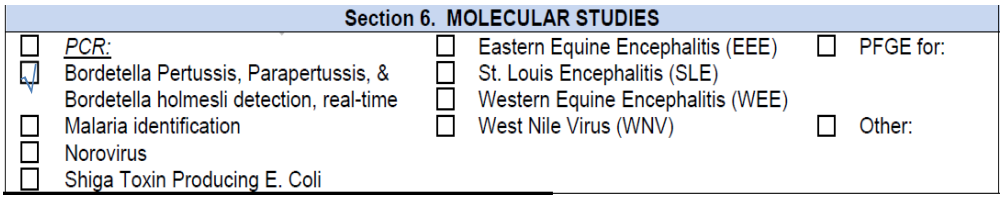
Appropriate positioning of a nasopharyngeal swab



- Use a Rayon or Dacron nasopharyngeal swab with aluminum or plastic handles.
    - If you are not using swabs provided through the DSHS testing kit, be sure the swab you are using is a “mini-tip” Rayon or Dacron swab.
- Immobilize the patient’s head.
- Gently insert nasopharyngeal swab into a nostril until the posterior nares is reached.
- Leave the swab in place for up to 10 seconds. This procedure may induce coughing and tearing.
- If resistance is encountered during insertion
- of the swab, remove it and attempt insertion on the opposite nostril.
- Remove the swab slowly.
- After collection, the swab should be inserted back into the dry transport tube. Store at 2-8°C until shipment at refrigerated temperature (2-8°C).

Submission Form

- Use a G-2B Specimen Submission Form.
- Make sure the patient's name and date of birth or social security number match exactly what is written on the transport tubes.
- Fill in the date of collection, date of onset, and diagnosis/symptoms.
- On the DSHS Specimen Submission Form G-2B, in section 6: Molecular Studies, check PCR Bordetella Pertussis.



Section 6. MOLECULAR STUDIES		
☐ *PCR:*	☐ Eastern Equine Encephalitis (EEE)	☐ PFGE for:
☑ Bordetella Pertussis, Parapertussis, & Bordetella holmesli detection, real-time	☐ St. Louis Encephalitis (SLE)	
☐ Malaria identification	☐ Western Equine Encephalitis (WEE)	
☐ Norovirus	☐ West Nile Virus (WNV)	☐ Other:
☐ Shiga Toxin Producing E. Coli		

Specimen Shipping

- Transport temperature: Keep at 2-8^{o}C (refrigerated).
- Ship specimens via overnight delivery on cold packs or wet ice (double bagged) within48 hours of collection.
- DO NOT mail on a Friday unless special arrangements have been pre-arranged with DSHS Laboratory.
- Ship specimens to:

Laboratory Services Section, MC-1947
Texas Department of State Health Services
Attn. Walter Douglass (512) 776-7569
1100 West 49th Street
Austin, TX 78756-3199

Causes for Rejection:

- Discrepancy between name on tube and name on form
- Incorrect swab (must use nasopharyngeal swab)
- Obvious contamination with blood
- Tube broken in transport
- Received at ambient temperature

REVISION HISTORY

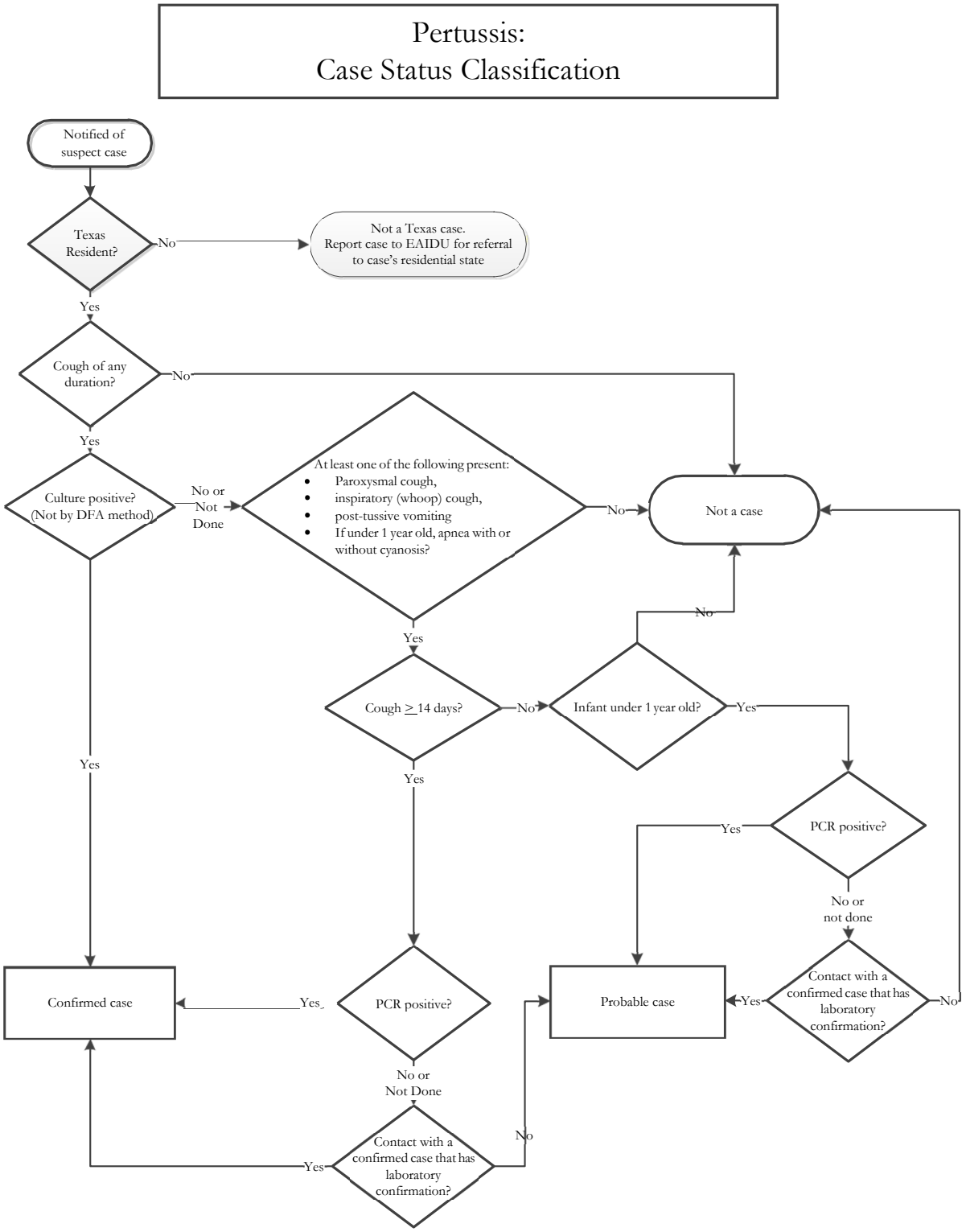
March 2021

- Pertussis case definition updated.
- Updated postexposure prophylaxis guideline wording to match CDC and for clarity
- Updated structure for Managing Close Contacts and Prophylaxis Guidelines
- Updated Outbreaks section of Managing Special Situations
- Updated flow chart

December 2022

- Updated Case Investigation Checklist

FLOW CHARTS


Pertussis:
Case Status Classification
Notified of suspect case
Texas Resident?
No
Not a Texas case. Report case to EAIDU for referral to case's residential state
Yes
Cough of any duration?
No
Yes
Culture positive? (Not by DFA method)
No or Not Done
At least one of the following present:
Paroxysmal cough,
inspiratory (whoop) cough,
post-tussive vomiting
If under 1 year old, apnea with or without cyanosis?
No
Not a case
Yes
No
Cough ≥ 14 days?
No
Infant under 1 year old?
Yes
Yes
Yes
PCR positive?
Yes
No or not done
Confirmed case
Yes
PCR positive?
Probable case
Yes
Contact with a confirmed case that has laboratory confirmation?
No
No or Not Done
No
Yes
Contact with a confirmed case that has laboratory confirmation?

Pertussis:
Case Status Classification