Utah Department of Health & Human Services

Pertussis (Whooping cough)

Disease plan

Quick links

Last updated: August 1, 2019 by Bree Barbeau

Updated to match DHHS style guide and terminology: February 23, 2024

Questions about this disease plan?

Contact the Utah Department of Health and Human Services Office of Communicable Diseases: 801-538-6191.

Pertussis critical clinician information

Clinical evidence

Signs/symptoms

- Non-specific respiratory symptoms; worsening cough, lasting at least 2 weeks
- Paroxysmal coughing
- High-pitched inspiratory whoop
- Apnea with or without cyanosis
- Post-tussive vomiting

Period of communicability

- During catarrhal stage (defined on page 4) and the first 2 weeks after cough onset
- Not infectious after 5 days of appropriate antibiotic treatment

Incubation period

- Average 7–10 days; range of 4–21 days

Mode of transmission

- Respiratory droplets
- Contact with infected fomites

Laboratory testing

Type of lab test	Also known as	Type of specimens	Collection timing
PCR (Preferred)	Nucleic acid test (NAT), NAAT	Nasopharyngeal swabs or aspirates or bronchoalveolar lavage (BAL)	Collect 0–3 weeks following cough onset
Culture (gold standard)		Nasopharyngeal swabs or aspirates or washings	Collect during first 2 weeks of cough
Serology (non-confirmatory)	IgM, IgG, IgA, antibodies	Serum	Useful **ONLY** when cough has persisted for >3 weeks

Treatment recommendations

Type of treatment

- Azithromycin (Recommended)
  - Infants <6 months of age: 10mg/kg per day for 5 days
  - Infants and children ≥6 months of age: 10mg/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 (Z Pak)
- Clarithromycin
  - Infants <1 month of age: not recommended.

- Infants and children >1 month of age: 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

● Erythromycin

- Infants <1 month of age: not preferred because of risk for infantile hypertrophic pyloric stenosis (IHPS). If azithromycin is unavailable and erythromycin is used, the dose is 40–50 mg/kg per day in 4 divided doses. These infants should be monitored for IHPS.
- Infants >1 month of age 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

● TMP-SMX (Bactrim, Sulfatrim, Septra)

- Adolescents and adults: 1 double strength tablet twice daily for 14 days is an acceptable alternative.
- Infants and children: is an alternative for children >2 months of age who have a contraindication to or cannot tolerate macrolide agents.
- TMP-SMX should not be used in infants <2 months of age because of the potential risk of kernicterus related to bilirubin displacement.

For more treatment information, visit
http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5414a1.htm

Time period to treat

- Preferable to collect laboratory specimens prior to treatment.
- Before paroxysmal coughing begins, if possible (earlier treatment may lessen the severity of disease/transmission risk).
- Infants <1 year of age and pregnant women are recommended to be treated up to 6 weeks after cough onset.
- Likely not effective after 3 weeks of illness.

Post-exposure prophylaxis

- All household and close contacts should receive prophylaxis regardless of age and vaccination status, particularly persons with high risk of developing severe pertussis, and those who will have close contact with those at high risk of developing severe pertussis.
- Initiating >3 weeks after exposure is likely not beneficial for contacts; however, it may be considered beneficial for high-risk infants or pregnant women up to 6 weeks after exposure.

Case and contact management

To provide future protection, contacts' immunization history should be assessed and brought up to date according to current ACIP guidance, as needed.

Isolation of case

- Patients with pertussis may not return to work, school, or childcare settings until after 5 days of appropriate antibiotic therapy.
- Patients with pertussis who were not treated with appropriate antibiotic therapy may not return to work, school, or childcare settings for 21 days after cough onset.

Quarantine of contacts

- While quarantine is not typically indicated for asymptomatic contacts of a pertussis case, high-risk contacts (infants <12 months of age, pregnant women, etc.) and susceptible unimmunized or under-immunized contacts may be recommended for quarantine at the discretion of the local health authority.

Infection control procedures

- Healthcare settings should follow droplet precautions for cases until completion of appropriate antibiotic therapy, or, if not treated, until 21 days after the onset of cough.
- *B. pertussis* may survive for 3–5 days on inanimate dry surfaces; 5 days on clothes, 2 days on paper, and 6 days on glass, so appropriate cleaning is critical.
- *B. pertussis* has been shown to be sensitive to glutaraldehyde; most vegetative bacteria are susceptible to low concentrations of chlorine, such as Clorox, or Purex (<1ppm), 70% ethanol, or phenolics such as Pine-Sol, Lysol, Triclosan (0.001% to 0.2%).

Why is pertussis important to public health?

Pertussis, a respiratory illness commonly known as whooping cough, is a very contagious disease caused by a type of bacteria called *Bordetella pertussis*. These bacteria attach to the cilia (tiny, hair-like extensions) that line part of the upper respiratory system. The bacteria release toxins (poisons), which damage the cilia and cause airways to swell. Pertussis is the most poorly controlled bacterial vaccine-preventable disease in the U.S., with peaks in disease occurring every 3-5 years. Although routine childhood vaccination has resulted in substantial reductions in disease, the number of reported pertussis cases has been steadily increasing since the 1980s. Notable peaks in disease occurred in 2004 (25,827 cases, 27 deaths), 2010 (27,550 cases, 27 deaths), and most recently in 2012 when more than 41,000 cases and 18 deaths were reported, the largest number of cases in the U.S. since 1959. Furthermore, the epidemiologic features of pertussis have changed in recent years with an increasing burden of disease among fully-vaccinated children and adolescents.

Disease and epidemiology

Clinical description

Pertussis is a highly contagious toxin-mediated bacterial disease that interferes with the body's ability to clear pulmonary secretions. Pertussis can be categorized into 3 stages.

- **Catarrhal stage**: characterized by non-specific respiratory symptoms with a worsening cough. It generally lasts 1–2 weeks.
- **Paroxysmal stage:** where most diagnosis occurs. Symptoms include sudden, severe coughing fits (paroxysms). These fits are often followed by a high-pitched whoop when the person breathes in. Persons may become cyanotic due to a lack of oxygen, and may vomit after a coughing fit. Infants and children generally have the most severe symptoms. In children younger than 6 months of age, the most common symptom is apnea, and the whoop is often absent. Older children and adults may also lack the whoop, with a prolonged cough as the most common symptom. This paroxysmal stage can last for 1–6 weeks, sometimes lasting as long as 10 weeks.
- **Convalescent stage:** the patient gradually recovers from the disease. The cough becomes less paroxysmal and disappears in 2–3 weeks.

Subsequent respiratory infections may elicit paroxysms for months after the onset of pertussis. Milder disease is often seen in adolescents and adults and those who are partially protected because of vaccination.

Infants younger than 12 months of age are at the greatest risk of complications from pertussis infection. Bacterial pneumonia is the most common complication and cause of

pertussis-associated deaths. The lack of oxygen caused by coughing can produce neurological disorders like seizures and encephalopathy (a dysfunction of the brain). Other complications include otitis media (ear infection), anorexia (loss of appetite), and dehydration. Complications resulting from pressure effects of severe paroxysms include pneumothorax (collection of gas or air in the chest cavity), epistaxis (nosebleed), subdural hematomas (swelling or mass of blood under the outer membrane covering the spinal cord), hernias (protrusion of organ through wall), and rectal prolapse (protrusion of rectal mucosa through the anus). Adolescents and adults may suffer from difficulty sleeping, urinary incontinence, pneumonia, and rib fracture.

Causative agent

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

Differential diagnosis

Typically, viruses cause upper respiratory infections/bronchitis. The frequency of pertussis as a cause of upper respiratory infection with prolonged cough varies, but can range from 5–20%. Other bacterial pathogens causing upper respiratory illnesses include *Bordetella parapertussis, Mycoplasma pneumoniae*, *Chlamydia trachomatis, Chlamydia pneumoniae, Bordetella bronchiseptica* and certain adenoviruses.

Laboratory identification

Laboratory testing			
Type of lab test	**Also known as**	**Type of specimens**	**Collection timing**
PCR (preferred)	Nucleic acid test (NAT), NAAT	Nasopharyngeal swabs or aspirates or bronchoalveolar lavage (BAL)	Collect 0–3 weeks following cough onset
Culture (gold standard)		Nasopharyngeal swabs or aspirates or washings	Collect during first 2 weeks of cough
Serology (non-confirmatory)	IgM, IgG, IgA, antibodies	Serum	Useful **only** when cough has persisted for >3 weeks

Laboratory testing of pertussis can guide both clinical and public health responses. Pertussis can be easily missed and confused with other causes of chronic cough, so laboratory testing is useful in appropriate diagnosis. Additionally, laboratory data can significantly contribute to public health's ability to recognize an outbreak. However, laboratory testing can often be difficult,

expensive, and may not be clinically useful. Laboratory testing may not be necessary in settings where the patient has clinically compatible symptoms and has exposure to a confirmed case, or where there is a documented outbreak in the community. Public health's recommendation for laboratory testing of individual cases should carefully consider the above circumstances, and should recognize that in certain situations, testing may not be necessary.

PCR

Currently, this test is the best option in most clinical circumstances. Specimens may be collected 0–3 weeks following cough onset but may provide accurate results up to 4 weeks after cough onset. This test provides acceptable sensitivity in children and adults, has a relatively short turnaround time, and is available at most commercial reference laboratories. Nasopharyngeal (NP) swabs and aspirates are the preferred method for specimen collection. PCR results may not be reliable after 5 days of appropriate antibiotic treatment. After the fourth week of cough, bacterial DNA rapidly diminishes, which increases the risk of false negative results.

PCR allows for confirmation and speciation among *Bordetella* species. Results should be interpreted along with the clinical symptoms and epidemiological information. PCR tests vary in specificity, so obtaining culture confirmation of pertussis for at least 1 suspicious case is recommended any time there is suspicion of a pertussis outbreak.

Note: NP swabs have thin wire shafts and are flexible. You cannot collect an NP specimen with a throat swab. Throat swabs and cough plates are not acceptable specimens.

Culture

Culture is the gold standard for pertussis diagnosis. However, it is highly specific only in the initial stages of disease (during first 2 weeks of cough), and the sensitivity varies widely. Additionally, the length of time to obtain results makes it unacceptable for determining patient therapy. NP swabs and aspirates are the preferred method for specimen collection. Pertussis DFA or PCR testing is always recommended in addition to culture. Generally this test may be used when:

- Using an on-site laboratory (transport decreases yield)
- Patients have not started taking antibiotics
- Patients are within 2 weeks of symptom onset
- Determining possible antibiotic resistance

Since culture is considered the gold standard, it is particularly important to isolate the bacterium and confirm the pertussis diagnosis if an outbreak is suspected. Many other respiratory pathogens have similar clinical symptoms to pertussis and co-infections are common. Culture will help identify strains of *Bordetella pertussis*. Identifying which strains of *Bordetella pertussis* are causing disease is of public health importance. Culture must be taken from NP aspirates collected between 0–2 weeks after symptom onset. PCR should ideally be tested from NP aspirates taken at

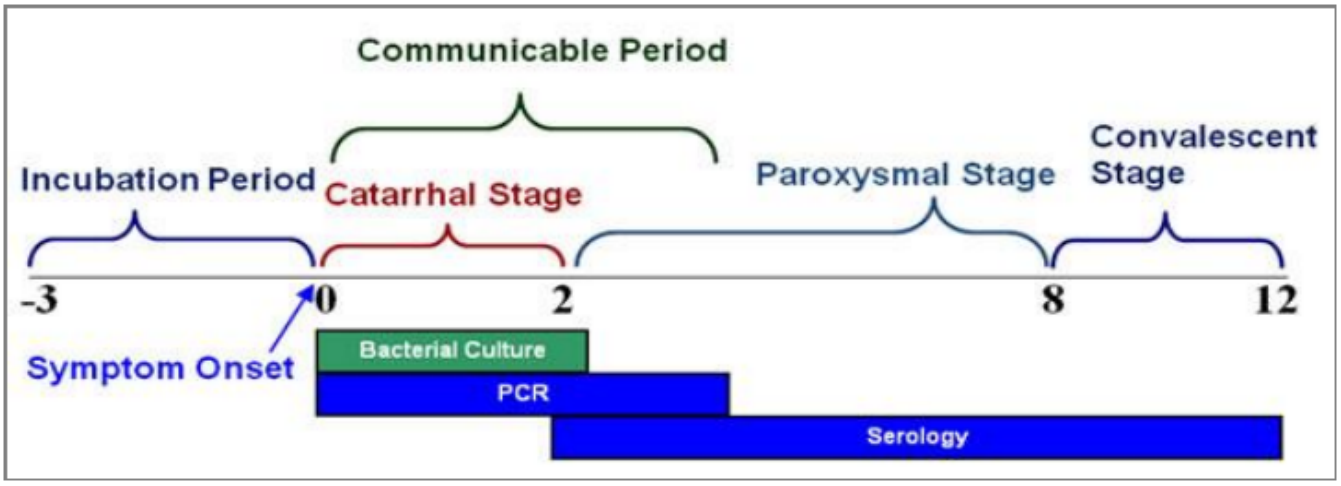
0–2 weeks, but may provide accurate results for up to 4 weeks in infants or unvaccinated persons. For serology, the optimal timing for specimen collection is at 2–8 weeks post-symptom onset, when antibody titers are at their highest; however, serology may be performed on specimens collected up to 12 weeks post-symptom onset.

Serology

Serologic assays can be useful for confirming diagnosis, especially during suspected outbreaks. There are many different serologic tests used in laboratories. Generally, serologic tests are more useful for diagnosis in later phases of the disease.

Serologic diagnosis requires paired acute and convalescent sera, and therefore it is not recommended for diagnosis due to the required wait for convalescent sera. The use of a single serum specimen for diagnostic purposes is not well standardized outside of a research setting. Serology is best used to evaluate a person's immune response to vaccination. Serological tests should never be used as the sole laboratory method of pertussis diagnosis.

Figure 1. Pertussis laboratory testing timing



Utah Public Health Laboratory (UPHL): UPHL offers testing of pertussis through the film array multiplex PCR platform. The film array test includes several other tests in addition to pertussis. Only NP swabs sent in viral transport media and kept refrigerated will be accepted for testing of pertussis. Contact the Utah Department of Health and Human Services (DHHS) Office of Communicable Diseases or UPHL to coordinate sample submission.

Treatment

Pertussis is generally treated with antibiotics, and early treatment is very important. Treatment may make infection less serious if it is started early, before coughing fits begin. Treatment can also help prevent spread of the disease to close contacts. Treatment after 3 weeks of illness is unlikely

to help, because the bacteria are gone from the body, even though patients will usually still have symptoms. An antibiotic effective against pertussis should be administered to all close contacts of persons with pertussis, regardless of age and vaccination status. There are several antibiotics available to treat pertussis as outlined in the following table:

Drug	Infants <1 month	Children 1–5 months	Children ≥6 months	Adults
Azithromycin	10 mg/kg per day as a single dose daily for 5 days	10 mg/kg per day as a single dose daily for 5 days	10 mg/kg as a single dose on day 1 (maximum 500 mg); then 5 mg/kg per day as a single dose on days 2–5 (maximum 250 mg/day)	500 mg as a single dose on day 1; then 250 mg per day as a single dose on days 2–5
Erythromycin	40 mg/kg per day in 4 divided doses for 14 days	40 mg/kg per day in 4 divided doses for 14 days	40 mg/kg per day in 4 divided doses for 7–14 days (maximum 1–2 g/day)	2 g per day in 4 divided doses for 7–14 days
Clarithromycin	Not recommended	15 mg/kg per day in 2 divided doses for 7 days	15 mg/kg per day in 2 divided doses for 7 days (maximum 1 g per day)	1 g per day in 2 divided doses for 7 days
TMP-SMX	Contraindicated for infants <2 months	Contraindicated for infants <2 months; for infants aged ≥2 months, 8 mg/kg per day (TMP); 40 mg/kg per day (SMX) in 2 divided doses for 14 days	8 mg/kg per day (TMP), 40 mg/kg per day (SMX) in 2 divided doses for 14 days	320 mg per day (TMP); 1,600 mg per day (SMX) in 2 divided doses for 14 days

Azithromycin is most popular because it is given in a short, simple regimen of 1 dose each day for 5 days. It is the preferred antimicrobial for use in infants younger than 1 month of age. Similarly, the regimen of 2 doses a day for 7 days makes clarithromycin another well-accepted choice. Erythromycin, which is given as 4 doses each day for 14 days, continues to be used, but adherence to the regimen and completion of the course is generally lower than for the other macrolides, and adverse effects occur more frequently.

If resistance to the listed treatment regimens is suspected, CDC recommends treatment with trimethoprim-sulfamethoxazole (TMP-SMX) in a regimen of 2 doses per day for 14 days. TMP-SMX should not be used to treat infants younger than 2 months of age.

Case fatality

Most fatalities from pertussis occur in infants younger than 6 months of age, who are too young to have completed the primary series of pertussis vaccines. The case fatality rate for pertussis among infants younger than 6 months of age is approximately 1%, with the majority of deaths occurring in those younger than 2 months. In unvaccinated populations, morbidity can be significant, but mortality is rare with appropriate medical care. However, because most reported pertussis cases in infants are hospitalized, complication rates are likely to be representative of more severe illness.

Reservoir

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

Transmission

Pertussis is transmitted via close contact with aerosolized droplets of respiratory secretions from infected persons. Transmission can also occur through contact with infected fomites. This disease is not thought to have airborne transmission. Pertussis is highly communicable, with secondary attack rates in susceptible household contacts as high as 90%. The majority of infectious patients are symptomatic, however, results of several studies suggest that asymptomatic transmission does occur and might be a contributing factor to the resurgence of pertussis in the U.S. While the contribution of asymptomatic transmission is not well defined, results of a recent study suggest that asymptomatic infection may contribute to about 16% of cases of disease transmission for infants <6 months of age.

Susceptibility

Susceptibility is universal in unimmunized persons. Pertussis immunity typically wanes 3–5 years after vaccination or natural infection. Past infection with pertussis, and/or vaccination history, does not confer lifetime immunity.

Incubation period

The average incubation period for pertussis is 7–10 days, with a range of 4–21 days, and rarely may be as long as 42 days.

Period of communicability

Patients are most contagious during the catarrhal stage and the first 2 weeks after cough onset (approximately 3 weeks from the initial onset of symptoms). Recent studies suggest that patients

with asymptomatic infection can transmit pertussis; however, because asymptomatic transmission is not well defined, it is difficult to determine the period of communicability for these patients. Patients are considered non-infectious after 5 days of appropriate antibiotic therapy.

Epidemiology

Outbreaks of pertussis typically occur every 3–4 years. The highest annual incidence of pertussis occurs among unvaccinated children <5 years of age. Secondary attack rates are approximately 90% among susceptible household contacts. During 2015, 20,762 cases of pertussis were reported to the CDC. This represents a 37% decrease compared to 32,971 cases reported during 2014.

Recently, both national and Utah trends demonstrate an increasing age in pertussis cases. It is unclear whether this is a real trend, or if it is due to increased recognition, diagnosis, and reporting of pertussis in adolescents and adults. It is hypothesized that widespread use of pertussis vaccine in children may be responsible for the shift in reported cases to adolescents/adults. In vaccinated populations, fewer mothers have acquired immunity through natural infection, and they may be less likely to provide passive immunity to an infant through transfer of maternal antibody. This leaves children under the age of 1 year as a significant at-risk population. The greatest burden of disease is in this population, with a Utah incidence rate of 41.5 cases per 100,000 population/year in 2016, compared to the overall statewide incidence rate of 9.1 cases per 100,000 population/year in 2016.

Pertussis rates in Utah were on the rise since 2009 and then show a decline from 2009–2014. In 2015, the number of reported pertussis cases in Utah was 16.6 per 100,000 persons/year, compared to the U.S. rate of 6.5 per 100,000 persons/year.

Weekly reports addressing the current situation are located on the DHHS Office of Communicable Diseases website at https://epi.health.utah.gov/pertussis-reports/.

Public health control measures

Public health responsibility

- Prevent illness in high-risk individuals through disease investigation, administration of vaccine, and antimicrobial prophylaxis.
- Promote vaccination to reduce disease burden in the community.
- Provide education to the general public (regarding disease transmission) and to clinicians (regarding disease diagnosis, reporting, and prevention).
- Monitor disease trends.

Prevention

Vaccines

The primary method of pertussis prevention is vaccination. In the U.S., the recommended pertussis vaccine for babies and children is called DTaP. This is a combination vaccine that helps protect against 3 diseases: diphtheria, tetanus, and pertussis. There is a booster (Tdap) for preteens, teens, and adults that contains protection against these 3 diseases.

Antibiotics

When a case of pertussis is diagnosed, preventive antibiotics may be recommended to other members in a household to help prevent the spread of disease. Additionally, preventive antibiotics may be recommended to other people outside the household who have been exposed to the case, including:

- People at risk for serious disease.
- People who have routine contact with someone that is considered at high risk of serious disease.

Hygiene

In addition to the prevention recommendations outlined above, CDC recommends the following hygiene practices to help prevent the spread of pertussis:

- Cover mouth and nose with a tissue when coughing or sneezing.
- Put used tissue in the wastebasket.
- Cough or sneeze into an upper sleeve or elbow, not hands, if a tissue is unavailable.
- Wash hands often with soap and water for at least 20 seconds.
- Use an alcohol-based hand rub if soap and water are not available.

Post-exposure prophylaxis (PEP)

Post-exposure antimicrobial prophylaxis (PEP) may reduce secondary transmission in household and other settings. DHHS recommends focusing efforts to provide PEP for high risk contacts and household contacts within the appropriate time frame.

CDC supports targeting PEP use to people at high risk of developing severe pertussis, as well as people who will have close contact with others at high risk of developing severe pertussis. The following CDC guidelines outline recommendations for the use of PEP among these groups:

- **Household contacts:** PEP should be administered to household contacts of a pertussis case within 21 days (3 weeks) of onset of cough in the index case. PEP of all household and close contacts is recommended regardless of their age and vaccination status. Initiating PEP >3 weeks after exposure has limited benefit for the contacts.

- **High-risk contacts:** Provide PEP to high-risk people within 21 days of exposure to an infectious pertussis case-patient. 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 and women in their third trimester of pregnancy**—severe and sometimes fatal pertussis-related complications occur in infants <12 months of age, especially among infants <4 months of age. Women in their third trimester of pregnancy may be a source of pertussis to their newborn infant.
    - **All people with pre-existing health conditions** that may be exacerbated by a pertussis infection (for example, but not limited to, immunocompromised people and those with moderate to severe medically treated asthma).
    - **People who themselves have close contact with either infants <12 months of age, pregnant women or individuals with pre-existing health conditions at risk of severe illness or complications.**
    - **All people in high-risk settings that include infants <12 months of age or women in the third trimester of pregnancy.** These include, but are not limited to neonatal intensive care units, childcare settings, and maternity wards.

A broader use of PEP 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.

***Note*:** Other contacts can be provided antibiotics at the discretion of the local health authority.

Vaccine

There are several formulations of vaccines used to prevent diphtheria, tetanus, and pertussis. Some are combined with vaccines to prevent other diseases and reduce the total number of shots that someone receives at one office visit. In the U.S., DTaP, Tdap, and Td vaccines are most commonly used. DTaP is given to children younger than 7 years of age, and Tdap and Td are given to older children and adults.

DTaP: Diphtheria vaccine is complexed with acellular pertussis and tetanus toxoid, also known as DTaP. Immunization should be initiated in infancy. Children should get 5 doses of DTaP, 1 dose at each of the following ages:

- 2 months
- 4 months

- 6 months
- Between 15–18 months
- Between 4–6 years (before starting school).

Td: Td is a tetanus-diphtheria vaccine given to adolescents and adults as a booster shot every 10 years, or after an exposure to tetanus under some circumstances.

Tdap: ACIP recommends a single Tdap dose for persons 11–18 years of age who have completed the recommended childhood diphtheria and tetanus toxoids and pertussis/diphtheria and tetanus toxoids and acellular pertussis (DTP/DTaP) vaccination series and for adults 19–64 years of age. Expectant mothers should receive Tdap during each pregnancy, preferably at 27 through 36 weeks. Tdap should also be given to children 7–10 years of age who are not fully immunized against pertussis. Tdap can be given no matter when Td was last received.

In February 2013, ACIP issued the recommendation that pregnant women should be vaccinated with Tdap during every pregnancy, regardless of previous vaccination with Tdap. Tdap may be administered any time during pregnancy, but vaccination during the third trimester would provide the highest concentration of maternal antibodies to be transferred closer to birth. After receipt of Tdap, persons should continue to receive Td every 10 years for routine booster immunization against tetanus and diphtheria. ACIP also recommends that all adolescents and adults who anticipate close contact with an infant <12 months of age receive a dose of Tdap if they have not previously received one.

For additional information about who should receive the Tdap vaccine and when, go to https://www.cdc.gov/vaccines/schedules/index.html

Vaccine storage and handling

DTaP, Td, and Tdap vaccines should be stored at 35–46ºF at all times. The vaccines should never be frozen. Vaccines exposed to freezing temperature must not be administered and should be discarded. DTaP, Td, and Tdap should not be used after the expiration date printed on the box or label.

Isolation and quarantine requirements

Isolation: Cases with pertussis should remain out of school or childcare settings until they have received 5 days of appropriate antibiotic therapy, or, if not treated, until 21 days after the onset of cough. Voluntary isolation from work and other settings where the case may transmit the disease is desirable.

Healthcare settings: Healthcare worker cases should remain out of work until completion of appropriate antibiotic therapy, or, if not treated, until 21 days after the onset of cough.

Quarantine: While quarantine is not typically indicated for asymptomatic contacts of a pertussis case, high-risk contacts (infants <12 months of age, pregnant women, etc.) and susceptible unimmunized or under-immunized contacts may be recommended for quarantine at the discretion of the local health authority.

R396-100-8. Exclusions of Students Who Are Under Exemption and Conditionally Enrolled Status.
(1) A local or state health department representative may exclude a student who has claimed an exemption or who is conditionally enrolled from school attendance if there is good cause to believe that the student has a vaccine preventable disease and:

(a) has been exposed to a vaccine-preventable disease; or
(b) will be exposed to a vaccine-preventable disease as a result of school attendance.

(2) An excluded student may not attend school until the local health officer is satisfied that a student is no longer at risk of contracting or transmitting a vaccine-preventable disease.

NOTE: Guidance documents specific to school and childcare settings can be found at https://epi.utah.gov/pertussis-outbreak-recommendations/

Case investigation

Reporting

If pertussis is suspected, it should be reported to the local health department or DHHS.

Clinical criteria for reporting

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

Laboratory criteria for reporting

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

Epidemiologic linkage criteria for reporting

- An acute cough illness of any duration in a person who is a contact of a laboratory confirmed pertussis case.

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

Vital records criteria for reporting

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

Other criteria for reporting

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

Reporting criteria (2019)

Criterion	**Pertussis**		
Clinical criteria for reporting			
Cough (any duration)		N	N
Inspiratory whoop or paroxysmal cough or post-tussive vomiting or apnea		N	
Laboratory criteria for reporting			
Isolation of *B. pertussis* from a clinical specimen	S		
Positive PCR for *B. pertussis*	S		
Epidemiological linkage criteria for reporting			
Contact with a lab-confirmed pertussis case			O
Member of a defined risk group during an outbreak			O
Vital records criteria for reporting			
Death certificate lists pertussis as a cause of death or a significant condition contributing to death	S		
Other criteria for reporting			
Healthcare record contains diagnosis of pertussis	S		

Notes:
S = This criterion alone is SUFFICIENT to report a case.
N = All "N" criteria in the same column are NECESSARY to report a case.
O = At least one of these "O" (ONE OR MORE) criteria in each category (categories=clinical evidence, laboratory evidence, and epidemiological evidence) in the
same column—in conjunction with all "N" criteria in the same column—is required to report a case.

Case definition

Pertussis (Bordetella pertussis) (2019)

Clinical criteria

In the absence of a more likely diagnosis, a cough illness lasting ≥2 weeks, with at least 1 of the following signs or symptoms:

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

Laboratory criteria

Confirmatory laboratory evidence:

- Isolation of *B. pertussis* from a clinical specimen
- Positive 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
    - Polymerase chain reaction (PCR) positive for *B. pertussis*

Probable:

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

OR

- Illness with cough of any duration, with
    - At least 1 of the following signs or symptoms:
        - Paroxysms of coughing; or
        - Inspiratory whoop; or
        - Post-tussive vomiting; or
        - Apnea (with or without cyanosis)

        AND
    - Contact with a laboratory confirmed case (epidemiologic linkage)

Case classification criteria (2019)

Criterion	Confirmed	Probable	Probable
Clinical evidence			
Acute cough illness (any duration)	N		N
Cough ≥2 weeks duration		N	
Inspiratory whoop		O	O
Paroxysms of coughing		O	O
Post-tussive vomiting		O	O
Apnea (with or without cyanosis)		O	O
Absence of a more likely diagnosis		N	
Laboratory evidence			
Isolation of *B. pertussis* from a clinical specimen	O		
Positive PCR for *B. pertussis*	O		
Epidemiological evidence			
Contact with a laboratory-confirmed case (classified as "confirmed")			N

Notes:
N = All "N" criteria in the same column are NECESSARY to classify a case. A number following an "N" indicates that this criterion is only required for a specific disease/condition subtype (see below). If the absence of a criterion (i.e., criterion NOT present) is required for the case to meet the classification criteria, list the absence of criterion as a necessary component.
O = At least one of these "O" (ONE OR MORE) criteria in each category (categories=clinical evidence, laboratory evidence, and epidemiologic evidence) in the same column—in conjunction with all "N" criteria in the same column—is required to classify a case. A number following an "O" indicates that this criterion is only required for a specific disease/condition subtype

Case investigation process

Cases of pertussis should be managed as follows:

- Encourage appropriate laboratory testing.
- Ensure appropriate antibiotic treatment.
    - Generally recommended for those who are within three weeks (<21 days) of the onset of their illness.

    - Infants <1 year of age, pregnant women, and persons with ongoing, close contact with infants <1 year of age or pregnant women (e.g., childcare workers, pediatricians), should be treated regardless of duration.
- Isolation should be imposed until 21 days after the onset of symptoms, or five days after appropriate antibiotic therapy is begun.
- All case contacts should be identified and appropriately managed (explained in detail below).
- The investigation of cases should not be finalized at the local health department in UT-NEDSS/EpiTrax until at least 2 weeks after the illness onset date to ensure the appropriate case status is assigned, according to the CSTE case definition. In many cases this will require some follow-up after the initial interview, depending on date of onset and when the interview is conducted.
- In the investigation form, there is a question regarding up-to-date vaccination status that is for public health investigators to answer, not the patient/guardian being interviewed. This question should be answered based on the information about vaccine history provided and the age of the patient being interviewed. Per current ACIP recommendations, a case is considered up-to-date under the following circumstances:
    - Infants and children who have received 4 doses of DTaP, administered at 2, 4, and 6 months, 15 through 18 months, followed by a fifth booster dose given at 4–6 years of age.
    - Adolescents and adults who have received a single dose of Tdap; usually administered at 11–12 years of age.

Outbreaks

Depending on the setting, a pertussis outbreak is defined as:

- **Household:** Two or more cases within a 21-day period of each other, AND 1 of these cases must be laboratory confirmed.
- **School:** Three or more cases identified within a 21-day period AND 1 of these cases must be laboratory confirmed.
- **Childcare facility *with* infants <1 year of age:** One case identified within a 21-day period (laboratory confirmed).
- **Childcare facility *without* infants <1 year of age:** Two cases identified within a 21-day period AND one of these cases must be laboratory confirmed.

DHHS, in collaboration with local health departments, has developed outbreak guideline documents for use during an outbreak in schools and childcare settings. These outbreak recommendations were developed to provide statewide consistency in situations involving pertussis outbreaks. The purpose of these guidelines is to provide effective management tools for

pertussis outbreak situations. The primary goal of pertussis outbreak control efforts is to decrease morbidity (amount of disease) and mortality (death) among infants (children <1 year of age). A secondary goal is to decrease morbidity among persons of all ages. A unified approach across the state will ensure public health messaging and actions regarding pertussis are clear and consistent to aid in the prevention of pertussis. Outbreak and exclusion guideline documents can be found at https://epi.utah.gov/pertussis-outbreak-recommendations/

Identifying case contacts

A close contact is defined as direct contact with respiratory, oral or nasal secretions from a symptomatic case-patient, direct face-to-face contact with a case-patient who is symptomatic, regardless of duration; or shared confined space in close proximity (within 3 feet) for a prolonged period of time (over 1 hour) with a symptomatic case-patient. Consider members of the following groups:

- Household and immediate family members (those who spend many hours together or sleep under the same roof)
- Those who have direct contact with respiratory secretions
- Healthcare workers with extensive face-to-face contact with a patient who is coughing
- Core groups of close friends, social contacts, boyfriends, girlfriends
- Students sitting within 3 feet of the case at school
- Contacts at church activities and employment
- Participants in extracurricular activities (such as field trips)
- Children attending childcare, after-school care, or a playgroup

Household contacts: PEP should be administered to household contacts of a pertussis case within 21 days (3 weeks) of onset of cough in the index case. PEP of all household contacts is recommended regardless of age or vaccination status. Initiating PEP >3 weeks after exposure has limited benefit for the contacts.

High-risk contacts: In addition, a subset of close contacts are considered high-risk contacts because of the severity of disease, or the likelihood of transmitting infection to those at risk of severe disease, and are recommended PEP. Provide PEP to high-risk contacts within 21 days of exposure to an infectious pertussis case. High-risk contacts 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. For the purposes of this guidance, high-risk contacts include:

- **Infants and women in their third trimester of pregnancy**: severe and sometimes fatal pertussis-related complications occur in infants <12 months of age, especially among infants <4 months of age. Women in their third trimester of pregnancy may be a source of pertussis to their newborn infant.

- **All people with pre-existing health conditions** that may be exacerbated by a pertussis infection (for example, but not limited to, immunocompromised people and those with moderate to severe medically treated asthma).
- **People who themselves have close contact with either infants <12 months of age, pregnant women or individuals with pre-existing health conditions at risk of severe illness or complications.**
- **All people in high-risk settings that include infants <12 months of age or women in the third trimester of pregnancy.** These include, but are not limited to neonatal intensive care units, childcare settings, and maternity wards.

Management of immunocompromised contacts should be made on a case-by-case basis.

Case contact management

Asymptomatic contacts

- Make sure all close contacts and high risk groups (defined in previous section) receive appropriate PEP. For PEP recommendations, refer back to the PEP section of this plan.
- Assess immunization status and provide recommendations for DTaP/Tdap vaccination based on current ACIP recommendations.

Symptomatic contacts

- Recommend all symptomatic contacts obtain medical evaluation, including confirmatory laboratory testing and appropriate antibiotic therapy if pertussis is identified.
- If symptomatic contacts refuse to obtain medical evaluation, consider providing PEP. For PEP recommendations, refer back to the PEP section of this plan.
- Recommend symptomatic contacts avoid exposure to high-risk groups (defined in previous section).
- For isolation and quarantine recommendations for symptomatic contacts, refer to the isolation and quarantine requirements section of this plan.

Healthcare contacts

- Respiratory precautions should be taken to prevent unprotected exposure to pertussis.
- PEP is recommended for all healthcare personnel who have unprotected exposure to pertussis and are likely to expose a patient at risk for severe pertussis (e.g., hospitalized neonates and pregnant women).

References

Control of Communicable Diseases Manual (20th Edition), David L. Heymann MD, Ed., 2015.

CDC: Guidelines for the Control of Pertussis Outbreaks (2005 revision).Red Book: 2015 Report of the Committee on Infectious Diseases (30th Edition), American Academy of Pediatrics, Ed. 2015.

Principles and Practice of Infectious Diseases (6th Edition), Gerald L. Mandell, John E. Bennett, and Raphael Dolin Eds., 2005.

Pertussis Investigation Guidelines, State of Oregon, 2005.

CD Summary, Vol 54 (9), Oregon Department of Human Services, 2005.

Pichichero, ME, et.al., Combined Tetanus, Diphtheria, and 5-Component Pertussis Vaccine for use in Adolescents and Adults; JAMA 293 (24), 3003-3011, 2005.

Preziosi, MP, and Halloran, ME, Effects of Pertussis Vaccination on Disease: Vaccine Efficacy in Reducing Clinical Severity; Clin. Infect. Dis. 37 (6), 772-779, 2003.

Poland GA. The Growing Paradigm of Preventing Disease: Vaccines to Prevent Herpes Zoster and Pertussis in Adults. Annals Int Med 2005;143:539-541.

ARUP Consult. The Physician's Guide to Laboratory Test Selection and Interpretation. http://www.arupconsult.com/Topics/WhoopingCough.html

Council for State and Territorial Epidemiologists. CSTE Position Statements 2013. https://cdn.ymaws.com/www.cste.org/resource/resmgr/PS/13-ID-15.pdf

Kretsinger, K, et.al , Preventing Tetanus, Diphtheria, and Pertussis Among Adults: Use of Tetanus Toxoid, Reduced Diphtheria Toxoid and Acellular Pertussis Vaccine; MMWR: Morbidity and Mortality Weekly Report 15 December 2006. 55(RR17):1-33. http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5517a1.htm

CDC Laboratory Diagnosis of Pertussis website. http://www.cdc.gov/pertussis/clinical/diagnostic.html (Accessed 08/28/2014).

CDC Surveillance and Reporting website. http://www.cdc.gov/pertussis/surv-reporting.html (Accessed 03/8/2016).

Advisory Committee on Immunization Practices. October 2011 updated recommendations for use of Tdap in Pregnant Women: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6041a4.htm (Accessed 08/28/2014).

Advisory Committee on Immunization Practices. January 2011 updated recommendations for use of Tdap: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6001a4.htm (Accessed 10/24/2012).

Centers for Disease Control and Prevention. *Updated Recommendations for Use of Tetanus Toxoid, Reduced Diphtheria Toxoid, and Acellular Pertussis Vaccine (Tdap) in Pregnant Women- Advisory Committee on Immunization Practices (ACIP), 2012.* MMWR February 22, 2013; 62 (07);131-135. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6207a4.htm (Accessed 08/28/2014).

Centers for Disease Control and Prevention, *Updated Recommendations for Use of Tetanus Toxoid, Reduced Diphtheria Toxoid, and Acellular Pertussis (Tdap) Vaccine in Adults Aged 65 Years and Older (ACIP), 2012*. MMWR, June 29, 2012 / 61(25);468-470. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6125a4.htm (Accessed 08/28/2014).

Centers for Disease Control and Prevention*, Preventing Tetanus, Diphtheria, and Pertussis among ADOLESCENTS: Use of Tetanus Toxoid, Reduced Diphtheria Toxoid and Acellular Pertussis Vaccines.* MMWR, March 24, 2006, Vol 55, #RR-3. http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5503a1.htm (Accessed 08/29/2014).

Centers for Disease Control and Prevention, *Preventing Tetanus, Diphtheria, and Pertussis among ADULTS: Use of Tetanus Toxoid, Reduced Diphtheria Toxoid and Acellular Pertussis Vaccines.* MMWR, December 15, 2006, Vol 55, #RR17. http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5517a1.htm (Accessed 08/29/2014).

Centers for Disease Control and Prevention. *Epidemiology and Prevention of Vaccine-Preventable Diseases*. Hamborsky J, Kroger A,, Wolfe S, eds. 13th ed. Washington DC: Public Health Foundation, 2015.

Centers for Disease Control and Prevention. *Manual for the Surveillance of Vaccine-Preventable Diseases*. Roush S, McIntrye L, Baldy L, eds. 6th ed. Centers for Disease Control and Prevention, 2013.

Utah Department of Health and Human Services. Pertussis Outbreak Recommendations. https://epi.health.utah.gov/pertussis-outbreak-recommendations/ (Retrieved on 3/8/2016).

Centers for Disease Control and Prevention. Pertussis (Whooping Cough). http://www.cdc.gov/pertussis/outbreaks/pep.html (Retrieved on 3/8/2016).

Yeh, S, et al. Pertussis Infection in Infants and Children: Clinical Features and Diagnosis. UpToDate.com: https://www.uptodate.com/contents/pertussis-infection-in-infants-and-children-clinical-features-and-diagnosis (Accessed 7/17/2017).

Althouse, B, et al. Asymptomatic Transmission and the Resurgence of Bordetella Pertussis. BMC Medicine, 2015. https://bmcmedicine.biomedcentral.com/articles/10.1186/s12916-015-0382-8

Coudeville, L, et al. Adult Pertussis Vaccination Strategies and their Impact on Pertussis in the United States: Evaluation of Routine and Targeted Cocoon Strategies. Cambridge Core, 2008. https://www.cambridge.org/core/journals/epidemiology-and-infection/article/adult-pertussis-vaccination-strategies-and-their-impact-on-pertussis-in-the-united-states-evaluation-of-routine-and-targeted-cocoon-strategies/D71AD3BA98362D63FF5C4FC40F869513/core-reader

Crowcroft, NS, et al. Severe and Unrecognised: Pertussis in UK Infants. Archives of Disease in Childhood, 2006. http://adc.bmj.com/content/88/9/802

Centers for Disease Control and Prevention, *Pertussis (Whooping Cough) Prevention.* https://www.cdc.gov/pertussis/about/prevention/index.html (Accessed 09/28/2017).

Centers for Disease Control and Prevention, *Vaccines and Preventable Diseases: Diphtheria, Tetanus, and Pertussis Vaccine Recommendations.* https://www.cdc.gov/vaccines/vpd/dtap-tdap-td/hcp/recommendations.html (Accessed 09/28/2017).

Version control

Updated March 2016: Update to formatting of disease plan, added reporting narrative and swimlanes, added importance to public health section, added treatment section, added vaccine storage and handling information, added PFGE to laboratory identification; updates to other laboratory identification methods, reformatted vaccine information to make it more understandable; added additional information, added healthcare personnel outbreak information, added UT-NEDSS/EpiTrax minimum/required fields, updated references, updated epidemiology and Utah trends, updated identifying case contacts and added high-risk contact group. Updated link to outbreak recommendations, reviewed clinical description, chemoprophylaxis, CSTE case definition, case classification, reporting, and case contact management (no updates needed).

Updated July 2017: Updated to reflect changes discussed at VPD Disease Plan Workgroup.

Updated October 2017: Updated critical clinician information, laboratory identification, treatment, case fatality, transmission, susceptibility, period of communicability, epidemiology, prevention, post-exposure prophylaxis (pep), vaccine, isolation and quarantine requirements, case investigation process, outbreaks, identifying case contacts, case contact management, and references sections to reflect changes discussed at EAG VPD Disease Plan Workgroup.

Updated March 2018: Added rules for entering laboratory test results section.

Updated August 2019: Updated reporting and case classification tables and narratives to reflect new CSTE case definition.

Updated February 2024: Updated formatting to match DHHS style guide and terminology.

UT-NEDSS/EpiTrax minimum/required fields by tab

Demographic

- Area code
- Birth gender
- City
- County
- Date of birth
- Ethnicity
- Last name
- Phone number
- Race
- State
- Street
- ZIP code

Clinical

- Did cough last at least 2 weeks?
- Did patient have paroxysmal cough?
- Did patient have inspiratory whoop?
- Did patient have post-tussive vomiting?
- Did patient have apnea?
- Did patient have acute encephalopathy?
- Date of last pertussis-containing vaccine:
- What type of vaccine was administered?
- Date diagnosed
- Date of death
- Date of treatment
- Date treatment stopped
- Died
- Disease
- Onset date

Laboratory

- Organism
- Specimen source
- Test type
- Test result

Epidemiological

- Has the facility staff been alerted to watch for symptoms in contacts for 21 days after the last exposure?
- Name and location of daycare:
- Has case been excluded from childcare for the first 5 days of antibiotics or 21 days after cough onset if antibiotics were not taken? Has the childcare staff been alerted to watch for symptoms in contacts for 21 days after the last exposure?
- Attends school
- Name and location of school:
- Has case been excluded from school for the first 5 days of antibiotics or 21 days after cough onset if antibiotics were not taken?
- Has school administration been alerted to watch for symptoms in contacts for 21 days after the last exposure?
  Seizures
- Did the patient cough at the final interview?
- What are the results of a chest x-ray for pneumonia?
- What is the transmission setting?
- Was there secondary spread?
- Epi-linkage to a confirmed or probable case
- List names:
- Epi-linkage to a laboratory-confirmed case
- List names:

- Did the patient ever receive a diphtheria, tetanus, and/or pertussis-containing vaccine?
- If the subject did not receive at least 3 doses of pertussis-containing vaccine, why not?
- Was patient treated with antimicrobial agents? If so, what was the name of the medication, the date treatment began and ended.
- Date of exposure
- Imported from

Reporting

- Date first reported to public health

Administrative

- Outbreak name
- State case status
- Outbreak associated

Rules for entering laboratory test results

The following rules describe how laboratory results reported to public health should be added to new or existing events in UT-NEDSS/EpiTrax. These rules have been developed for the automated processing of electronic laboratory reports, although they apply to manual data entry, as well.

Test-specific rules

Test-specific rules describe what test type and test result combinations are allowed to create new morbidity events in UT-NEDSS/EpiTrax, and what test type and test result combinations are allowed to update existing events (morbidity or contact) in UT-NEDSS/EpiTrax.

Test type	Test result	Create a new event	Update an existing event
Antigen by DFA/IF	Positive	Yes	Yes
	Negative	No	Yes
IgA antibody	Positive	No	Yes
	Negative	No	Yes
	Equivocal	No	Yes
IgG antibody	Positive	No	Yes
	Negative	No	Yes
	Equivocal	No	Yes
IgM antibody	Positive	Yes	Yes
	Negative	No	Yes
	Equivocal	No	Yes
PCR/amplification	Positive	Yes	Yes
	Negative	No	Yes
	Other	No	Yes
Western (immuno) blot IgA	Positive	No	Yes
	Negative	No	Yes
	Equivocal	No	Yes
Western (immuno) blot IgG	Positive	No	Yes
	Negative	No	Yes
	Equivocal	No	Yes
Western (immuno) blot IgM	Positive	Yes	Yes
	Negative	No	Yes
	Equivocal	No	Yes
Culture	Positive	Yes	Yes
	Negative	No	Yes
	Equivocal	No	Yes

Whitelist rules

Whitelist rules describe how long an existing event can have new laboratory data appended to it. If a laboratory result falls outside the whitelist rules for an existing event, it should not be added to that event, and should be evaluated to determine if a new event (CMR) should be created.

Pertussis morbidity whitelist rule: If the specimen collection date of the laboratory result is 2 years or less after the event date of the morbidity event, the laboratory result should be added to the morbidity event.

Pertussis contact whitelist rule: If the specimen collection date of the laboratory result is 60 days or less after the event date of the contact event, the laboratory result should be added to the contact event.

Graylist rule

We often receive laboratory results through ELR that cannot create cases, but can be useful if a case is created in the future. These laboratory results go to the graylist. The graylist rule describes how long an existing event can have an old laboratory result appended to it.

Pertussis graylist rule: If the specimen collection date of the laboratory result is 30 days before to 7 days after the event date of the morbidity event, the laboratory result should be added to the morbidity event.

Other electronic laboratory processing rules

If an existing event has a state case status of “not a case,” ELR will never add additional test results to that case. New labs will be evaluated to determine if a new CMR should be created.