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DPH Influenza Testing Procedures During the 2011-2012 Flu Season

To identify influenza virus types, subtypes and strains circulating in Connecticut during the influenza season, the Department of Public Health (DPH) will offer influenza testing to the following:

- Hospitalized patients with influenza-like illness (ILI). The definition of ILI is fever >37.8° (100°F) plus cough or sore throat.
- Health care workers with direct patient contact responsibilities who develop ILI.
- Patients of ILINet providers who present with ILI. ILINet providers conduct sentinel influenza surveillance on behalf of the DPH and the United States Centers for Disease Control and Prevention.
- Patients who may be associated with institutional influenza outbreaks, such as residents in long-term care facilities, when testing is needed to guide control measures. Testing of selected specimens are based on recommendations of the DPH. Please contact the DPH Epidemiology and Emerging Infections Program (EEIP) before submitting specimens to the DPH Laboratory.

To request respiratory viral reference collection (VR-C) kits or for questions regarding the collection, handling, and transport of specimens, health care providers may call the DPH Laboratory at 860-509-8553. The kits and testing are provided at no cost for patients in one of the above listed categories. Health care providers who request testing patients associated with institutional outbreaks or have questions concerning DPH influenza surveillance efforts, testing for avian, swine-origin, or other novel influenza A strains, should contact the DPH EEIP at 860-509-7994.

Pertussis—Connecticut, 2007–2010

Pertussis, or whooping cough, is a highly contagious, and potentially life threatening, vaccine-preventable illness of the respiratory tract caused by the bacterium *Bordetella pertussis*. Illness is characterized by paroxysmal cough, posttussive vomiting, and inspiratory whoop. Persons who are partially immune may experience a mild or moderate cough illness (*1*). Laboratory confirmation is important to distinguish pertussis from other causes of prolonged cough illness that may require different prevention and control strategies. This report describes the epidemiology of pertussis cases reported to the Connecticut Department of Public Health (DPH) during 2007–2010, and includes some data reported previously to summarize diagnostic testing trends and fluctuations in case counts (*2*).

In Connecticut, suspected pertussis cases are reported to the DPH by physicians via phone and the Reportable Disease Confidential Case Report Form PD-23. Laboratories use the Laboratory Report of Significant Findings Form OL-15C to report positive serologies, cultures, polymerase chain reaction (PCR), and direct fluorescent antibody (DFA) results.

Cases are classified according to the national surveillance case definition (*3*). A probable case is defined as a cough illness lasting ≥2 weeks in a person with at least one of the following symptoms, paroxysms of coughing, inspiratory “whoop”; or post-tussive vomiting and absence of laboratory confirmation; and no epidemiologic linkage to a laboratory-confirmed case of pertussis. A confirmed case is defined as 1) an acute cough illness of any duration with isolation by culture of *B. pertussis* or 2) a case that is consistent with the probable case definition and is confirmed by PCR testing or by epidemiologic linkage to a laboratory-confirmed case. Laboratory criteria for diagnosis include isolation of *B. pertussis* from clinical specimen or positive PCR for pertussis.

During 2007–2010, a total of 309 cases of pertussis were reported to the DPH. Of these, 187 (61%) were confirmed of which, 37 (20%) were confirmed by culture, 129 (69%) by PCR, and 21 (11%) by epidemiologic linkage (Figure 1, page 44). Only one positive culture was reported from a non-hospital private lab. The number of hospital

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laboratories reporting positive pertussis cultures decreased from 6 in 2007, to 2 in 2010. While the percentage of confirmed cases has increased since a low of 21% in 2006, the percentage of cases confirmed by PCR has increased significantly during 2003–2010 ($p<0.01$, chi square for trend). During 2010, the first year lab-specific data were available, 72 positive PCR results were reported from 6 private laboratories to the DPH. Of these, 20 (28%) failed to meet the case definition (the remaining 2 were included in adjacent reporting year cases); 13 of these were reported by the same laboratory. During 2010, 3 laboratories reported 68 (94%) of the PCR positives with one lab reporting 48 (67%) of the total.

Little county-level incidence variation occurred during 2007–2010, other than in Litchfield County during 2010 when 52 cases were reported, an 11-fold rise in incidence compared with the average of the previous 3 years. Most of the cases occurred during the summer months, and leveled off by the end of September. Other than household transmission, none of these cases could be epidemiologically linked to a common setting, such as a school, workplace, or camp. Of the 31 cases with confirmatory testing, 26 (84%) were by PCR performed at a single private laboratory.

Of the 309 cases, 53 (17%) were aged <1 year (including 47 aged <6 months), 30 (10%) were 1–4 years, 64 (21%) were 5–9 years, 85 (28%) were 10–19 years, and 77 (25%) were ≥20 years (Figure 2). The number of cases among children <10 years of age increased significantly during the 4 year reporting period ($p<0.01$, chi square for trend). Using 2010 population data, the average annual incidence was highest among children <1 year of age (34.9 per 100,000 population), and lower in children aged 1–4 years (4.6), 5–9 years (7.2), 10–19 years (4.3), and ≥20 years (0.7). During 2007-2010, the statewide average annual incidence was 2.2 cases per 100,000 population.

Race and ethnicity data were analyzed independently. Data on race were available for 265 (86%) cases. Of these, 233 (88%) were white, 7 (3%) black, 5 (2%) Asian/Pacific Islander, 5 (2%) American Indian/Alaska Native, and 15 (6%) were identified as "other race." Data on ethnicity were available for 249 (81%) cases. Of these, 51 (20%) were Hispanic. Of infants <1 year of age with known ethnicity, 25 (53%) were Hispanic.

Of the 309 cases, 44 (14%) were hospitalized, of which 35 (80%) were ≤6 months of age. Pneumonia was radiographically confirmed in 13 cases. The median length of hospital stay was 4 days, no deaths were reported, and there was one report of seizures associated with pertussis.

Reported by

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Editorial

The overall incidence of pertussis in the United States has been increasing steadily since 2007 and surpassed peak rates observed during 2005; an increased incidence among younger age groups was also observed during recent years (*4*). Similar increases were seen in Connecticut. Compared with older age groups, infants continued to have the highest reported incidence of pertussis, with a higher proportion reported in Hispanic infants.

Diagnostic testing for pertussis remains challenging. Culture is specific and considered the

Figure 1. Incidence and numbers of reported pertussis cases by confirmation status and year, Connecticut, 2002-2010.

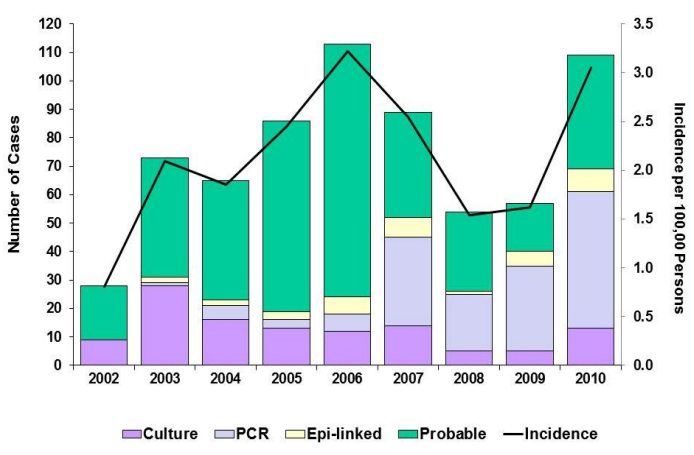
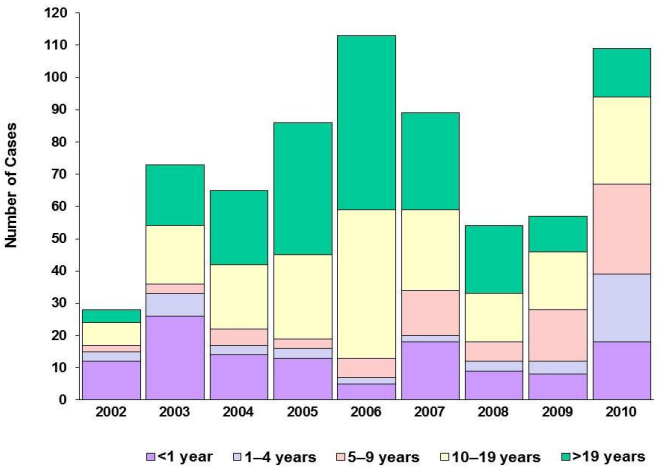


Figure 2. Number of pertussis cases by year and age group, Connecticut, 2002-2010.



gold standard but is not sensitive. PCR is more sensitive but PCR assays for pertussis are not standardized across clinical laboratories. Testing methods, DNA targets used, and result interpretation criteria vary, and laboratories do not use the same cutoffs for determining a positive result. High PCR-cycle threshold values indicate low levels of amplified DNA, which may indicate infection but can also be the result of specimens contaminated with DNA from the environment. In addition, most clinical laboratories use a single target PCR for IS481, which is present in multiple copies in *B.pertussis* and in lesser quantities in *B. holmesii* and *B. bronchiseptica*. Because this DNA sequence is present in multiple copies, IS481 is especially susceptible to falsely-positive results. Use of multiple targets may improve specificity of PCR assays for pertussis (*5*).

PCR-confirmed cases contribute an increasing proportion of the total number of reported confirmed cases (14% during 2002–2006 compared with 69% during 2007–2010) (*2*). Moreover, many cases confirmed by epidemiologic linkage to laboratory-confirmed cases are linked to PCR-confirmed cases, potentially multiplying the contribution of PCR testing to the overall number of cases reported. Because the majority of PCR testing is performed at just a few clinical laboratories, there is the potential for a major impact on pertussis surveillance in Connecticut based on the PCR testing method employed; at least 2 of the 3 labs reporting 94% of the PCR positive pertussis cases have a disclaimer stating that the PCR methodology does not distinguish between *B. pertussis* and *B. holmesii*. Since *B. holmesii* can cause a pertussis-like illness, it is unknown to what extent these reports might impact surveillance data.

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Protecting Infants From Pertussis: Results of a Survey of Pertussis Vaccine Use at Connecticut Birth Hospitals

Rates for pertussis-related complications and fatalities are highest in early infancy. Parents with pertussis, including new mothers, are the identified source of *Bordetella pertussis* infection in ≥25% of pertussis cases (*1*). Pertussis vaccine for adolescents and adults, known as tetanus-diphtheria -acellular pertussis (Tdap), was licensed in 2005 for one time use. In 2008, the Advisory Committee on Immunization Practices (ACIP) published recommendations that included a dose of Tdap for close contacts of newborns who have not previously been vaccinated, preferably before hospital discharge for postpartum mothers (*1*). The strategy behind the recommendation is known as "cocooning." Cocooning is intended to protect infants from becoming infected with highly contagious pertussis (whooping cough) by vaccinating family members who have close contact with them.

In 2008, the Connecticut Department of Public Health (DPH) Immunization Program established the Tdap Cocoon Program. The program's goal is to facilitate the ACIP recommendation to vaccinate new mothers with Tdap. The DPH recognized that the cost of Tdap is seen as prohibitive by hospitals because this vaccine has not yet been bundled into maternity charges covered by Medicaid or by many insurance plans. The Tdap Cocoon Program has also made Tdap available to fathers and age-eligible infant contacts (i.e., siblings, adoptive parents, grandparents, infant caregivers) as well as hospital health care workers. The vaccine is available free of cost to birth hospitals and participating referral sites. Vaccination of family members is accomplished primarily through a network of hospital referrals to pre-arranged sites.

To gain a better understanding of current practice at both participating and non-participating hospitals, and to estimate Tdap coverage in 2011 among postpartum women statewide, a survey of birth hospitals was conducted by the DPH. The survey was conducted by telephone with the postpartum nurse manager and in some cases, a hospital pharmacist. Data for Tdap doses administered from Tdap Cocoon Program order forms were also utilized for participating hospitals.

All 28 birth hospitals in Connecticut participated in the survey, although complete data were not available from all hospitals. Of the 28 hospitals, 26

(93%) reported offering Tdap to postpartum patients, but this total includes 2 hospitals not yet routinely offering vaccine to all patients. At the time of the survey, 20 hospitals were participating in the Tdap Cocoon Program, with an additional 6 hospitals privately purchasing vaccine. An immunization coverage rate for 2011 was calculated for program participants (n=20) based upon the number of Tdap doses administered to postpartum patients divided by the number of live births during the same time period (submitted monthly on the Tdap order form) and similarly for non-program participants based upon survey data (n=3). During 2011, the mean Tdap immunization rate for postpartum patients was 62% (confidence interval 53%–71%; median 62%, range 10%–91%). This rate represents 12,442 doses administered out of 20,901 live births. No attempt was made to correct for the impact on the coverage rate of past receipt of Tdap or multiple births.

T-tests were performed to examine hospital characteristics related to higher mean Tdap immunization rates including newborn hospital care level, inclusion of Tdap as part of the standard and/or default patient order sets, vaccine education documents used, who was responsible for discussing Tdap with patients, and recording the reason for patient refusal. One variable approached statistical significance; recording the reason for patient refusal of Tdap (one tailed p=0.05).

No hospitals reported vaccinating other family members or close contacts of the newborn at the postpartum unit. Of all hospitals included in the survey, 6 (21%) reported referring family members to an on-site hospital clinic for vaccination, (including a pediatric, occupational health (*2*), primary care, employee health, or walk-in clinic), 8 (29%) to a local health department for vaccination, and 2 (7%) to a Visiting Nurses Association. The remaining hospitals refer contacts to their primary care doctor or community health center.

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Editorial

Several studies reported Tdap immunization rates from a limited number of hospitals in postpartum patients. Rates ranged from 72%–86% (*2,3*) but to our knowledge a review in the literature of this size has not yet been published. We did not attempt to determine Tdap coverage in other infant contacts due to the difficulty of obtaining this information. Due to legal and logistical complexities, hospitals are limited in their abilities to vaccinate individuals who are not their patients. Referral systems are one way to vaccinate infant contacts but introduce a different set of barriers to vaccination. One such barrier is that not all primary care physicians stock Tdap; one study found that 83% of primary care physicians stocked Tdap vaccine in 2009 (*4*). It is not known if maternal Tdap vaccination only is protective for the newborn (i.e., incomplete cocooning).

In June 2011, the ACIP voted to preferentially recommend Tdap during pregnancy, and to administer in the immediate postpartum period if not given before that time. The full ACIP statement was published in October. The American College of Obstetrics and Gynecology is expected to endorse the new recommendation.

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