

# **Virginia Health Commissioner's Pertussis Prevention Task Force**

## **Report and Recommendations**

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## EXECUTIVE SUMMARY

Pertussis (whooping cough) is on the rise in Virginia. The number of cases reported in 2010 and 2011 were the highest in the past 7 years with an incidence rate in 2011 of approximately 5 per 100,000. While pertussis infection occurs across all ages, the highest disease rates are found among infants less than 1 year of age who often experience severe infection, hospitalization, and sometimes death. Older siblings, parents, grandparents, and other close contacts, whose immunity from childhood vaccines has waned, often unknowingly serve as the source of the infection. While coverage rates for the Tdap (tetanus, diphtheria, and pertussis) vaccine booster continue to rise among adolescents, coverage rates for adults remain suboptimal.

The “cocoon strategy” to prevent pertussis has been recommended by the Centers for Disease Control and Prevention (CDC) since 2006; it emphasizes pertussis vaccination of infant close contacts to surround the infant with a “cocoon” of protection. This strategy has not been widely implemented, however, and may be insufficient by itself in preventing infections among those most vulnerable. Recent updates to the CDC’s Tdap recommendations have removed barriers to facilitate the uptake of Tdap among adults and to protect newborns through the vaccination of pregnant women in their third or late second trimester.

These changes, in combination with the 2006 cocooning strategy, mean that everyone in contact with infants should be up to date with their pertussis vaccines. Processes need to be developed to optimize vaccination, as well as other strategies, such as education and systems change, to potentially reduce the rising rates of pertussis disease in our communities and prevent unnecessary deaths.

### **Task Force Charge**

The Virginia Department of Health’s Commissioner, Dr. Karen Remley, authorized the development of the Health Commissioner’s Pertussis Prevention Task Force in July 2011 and further charged this body with the development of pertussis prevention strategies and initiatives that would protect those most vulnerable to the spread of pertussis in Virginia. She further charged the group with the responsibility of developing recommendations that would be issued in a formal plan to address, at a minimum, the following areas:

- Area 1: Outreach and education for public and private clinicians
- Area 2: Targeted new parents and families and community vaccination campaigns
- Area 3: Health-care sector systems changes
- Area 4: Innovative models for vaccine delivery.

The task force members were unanimous in their view that pertussis prevention is best addressed by both public and private entities working together on multiple fronts. The task force researched prevention methods and modeled its recommendations to align with the CDC and the Joint Commission on Accreditation of Healthcare Organizations recommendations for pertussis prevention. The task force offers five recommendations focusing on: broadening coverage for Tdap vaccination; educating providers and the public regarding the importance of pertussis vaccination; developing tools and education materials; and updating regulations regarding Tdap vaccination for school children.

### **Recommendation #1 (Area 3)**

Explore opportunities for broadening Tdap vaccination coverage for adults in the Virginia State Plan to include the following:

- Initiate and maintain negotiations at the highest levels between VDH and the Department of Medical Assistant Services (DMAS) to effect change as follows:
  - Coverage for adult preventive services
  - Focus on pregnant and post-partum women and others with close infant contact who have Virginia State Medicaid (fee-for-service).
- Provide coverage for preventive purposes, not just for “medical necessity” in case of injury or direct exposure.

***Progress toward implementation:** Dr. Karen Remley, the VDH Health Commissioner, sent a letter in summer 2011 to DMAS recommending coverage of Tdap and influenza vaccines for pregnant women as a standard of care. Efforts are ongoing to expand coverage.*

### **Recommendation #2 (Areas 1, 3, 4)**

Implement a public health education campaign in which local health departments (LHDs) educate and collaborate with their healthcare providers, especially hospitals, to encourage implementation of the latest CDC vaccination recommendations and prevention strategies concerning pertussis. In providing this guidance, it was recommended that the following be included:

- A cost-effectiveness analysis for use of Tdap versus Td
- Recommendations for the implementation of Tdap standing orders in maternity wards, ERs, urgent care facilities, and outpatient clinics that may provide care for post-partum and post-injury care
- Occupational health policies for vaccination of healthcare personnel that include screening and vaccination for Tdap vaccination
- Clinician participation in the Vaccine Immunization Information Registry (VIIS), especially with entry of adult vaccinations such as Tdap.

***Progress toward implementation:** Efforts by the state and the local health departments to educate and collaborate with their healthcare providers regarding the latest CDC recommendations are ongoing. Please refer to the Appendix A, Accomplishments.*

### **Recommendation #3 (Areas 1 and 2)**

Develop and maintain a VDH-hosted pertussis prevention webpage, educational flyers, and frequently asked questions (FAQs) or fact sheets to educate members of the public and healthcare providers on the importance of Tdap vaccination and coverage of Tdap by health plans in Virginia. Include information targeted for pregnant women and older persons that reinforces messages of Tdap’s safety and benefits to help alleviate any concern about the most recent recommendations.

***Progress toward implementation:*** A Pertussis Prevention webpage with flyers and FAQs was developed in early 2012. Maintenance of the webpage is ongoing as is work to develop targeted materials for groups with the most recent Tdap recommendations.

**Recommendation #4 (Area 2)**

Consider amending the *Code of Virginia* to reflect the current Tdap guidelines from the Advisory Committee on Immunization Practices (ACIP) that eliminate the minimum interval since the last dose of tetanus-containing vaccine.

The current Code (effective 7/1/ 2006) requires a booster dose of Tdap vaccine for all children entering the 6th grade if at least 5 years have passed since the last dose of tetanus-containing vaccine. Eliminating the language allowing a < 5-year interval will help ensure all adolescents are protected from pertussis and are compliant with ACIP recommendations.

**Recommendation #5 (Area 1)**

Establish a permanent Immunization Advisory Committee to provide guidance to VDH's Division of Immunization on issues related to the use of vaccines for public health and the optimization of immunization practices.

***Progress toward implementation:*** Membership in the Immunization Advisory Committee is being formulated currently, and preliminary invitations have been disseminated. The first meeting of the committee will convene in summer 2012.

## TASK FORCE MEMBERSHIP

*Note: This page is in draft form and based on meeting minutes. These are in alphabetical order by last name.*

- Steve Arnold, M.D., Virginia Association of Health Plans
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## INTRODUCTION

*The following sections include information from “Epidemiology and Prevention of Vaccine-Preventable Diseases,” 12<sup>th</sup> ed., Centers for Disease Control and Prevention, 2011; “Pertussis (Whooping Cough) Guidelines Rev March 2011,” Virginia Department of Health; and “Tdap Vaccination Strategies for Adolescents and Adults, including Healthcare Personnel,” The Joint Commission, 2011.*

Pertussis, or whooping cough, is an acute respiratory infection caused by the bacterium *Bordetella pertussis*. Pertussis is a toxin-mediated disease, in which the bacteria attach to the cilia of the respiratory cells paralyzing the cilia and producing toxins that cause inflammation. It is a human disease transmitted person to person usually through contact with respiratory droplets shed when an infected person coughs or sneezes.

The incubation period is commonly 7 to 10 days, with a range of 4 to 21 days, and rarely as long as 42 days. Attack rates among exposed, non-immune household contacts can be as high as 80% (CDC, 2012). Pertussis initially can appear similar to other respiratory illnesses, including the common cold or influenza. Adolescents and adults, especially those with partial protection from vaccines, may have milder symptoms or even be asymptomatic; but they still can spread the disease. Classic pertussis infection has three distinct phases.

The first phase is the catarrhal stage and is characterized by the insidious onset of sneezing, low-grade fever, coryza, and a mild, short cough. This non-specific presentation commonly leads to misdiagnosis, although the catarrhal stage is the most infectious stage. As the cough gradually worsens after 1 to 2 weeks, the paroxysmal stage begins. The paroxysmal stage is characterized by fits of rapid and intense coughing. These episodes may involve choking or difficulty breathing, an inspiratory whoop, and post-tussive vomiting. The case-patient may appear normal between coughing fits. The paroxysmal stage usually lasts 2 to 3 weeks, during which pertussis infection may be suspected. The convalescent stage can last 2 to 6 weeks with the cough gradually becoming less paroxysmal. Symptoms of pertussis can last for more than 6 months.

The most frequent complication, and the cause of most pertussis-related morbidity, is secondary bacterial pneumonia. Approximately 5.2% of all reported cases from 1997 to 2000 resulted in pneumonia with a rate of 11.8% among infants less than 6 months of age (CDC, 2012).

Complications also include seizures, sleep apnea, hypoxia, and encephalopathy. Less severe complications include otitis media, anorexia, and dehydration. Pressure effects due to paroxysms may include, but are not limited to, urinary incontinence, hernias, pneumothorax (collapsed lung), subdural hematomas (bleeding in the brain), and rib fracture. Major complications are most common among infants and young children, but adolescents and adults also may develop complications.

Although death from pertussis is rare in the United States, the symptoms may continue for months; and the disease can be incapacitating. Infants less than 6 months of age and any

infant who has not yet received 3 doses of pertussis-containing vaccine are at elevated risk of pertussis infection, complications, and death.

The diagnosis of pertussis is based on a clinical history of cough more than 2 weeks in duration with whoop, paroxysms, or post-tussive vomiting. Laboratory tests include culture, polymerase chain reaction (PCR), direct fluorescent antibody (DFA), and serology. Culture is considered the gold standard laboratory test and is the most specific test for pertussis.

Medical management of pertussis cases is primarily supportive. Use of antibiotics can eradicate the organism from secretions, decrease communicability, and, if started early, may shorten illness duration. Antibiotics effective against pertussis include erythromycin, azithromycin, clarithromycin, and trimethoprim-sulfamethoxazole. Close contacts of pertussis cases are often recommended to receive antibiotics based on the date of their last exposure to the infectious case-patient. Prophylactic antibiotics may reduce secondary transmission.

## **SURVEILLANCE**

The *Code of Virginia* requires the State Board of Health to promulgate a list of diseases that must be reported, which are then set forth in the *Regulations for Disease Reporting and Control*. Pertussis has been a reportable disease in the United States since 1922. The regulations describe pertussis as a disease that is required by state law to be reported to the local or state health departments when “suspected or confirmed” by physicians, laboratories, and medical care facilities. Schools, child care centers, summer camps, and correctional facilities also are subject to reporting requirements.

Pertussis is a rapidly-reportable condition, meaning that a suspected or confirmed disease should be “reported immediately by the most rapid means available.” Outbreaks of any condition, including pertussis, are rapidly reportable by any facility that is licensed by the Commonwealth.

A report of suspected pertussis may start with a phone call from a clinician, school nurse, or parent; with an Epi-1 form completed by a health care professional to include basic demographic information and a pertussis diagnosis; or with a laboratory report showing a positive pertussis result. The report is investigated by epidemiologic staff in the health district corresponding to the case-patient’s residence. The investigation and recommendations for public health action are based on guidance in the *Disease Control Manual* and direction provided by the district’s Health Director and epidemiologic staff in the Division of Immunization.

Cases of pertussis are classified based on the case definitions established by the Council for State and Territorial Epidemiologists (CSTE) and CDC (see Figure 1 below). Pertussis cases that meet the Probable or Confirmed case classifications count toward Virginia's official morbidity statistics that are compiled by week, month and year. Cases are typically counted by date of disease onset or specimen collection, and sometimes by the date of case determination.

**Figure 1. Pertussis Case Definition**

|   |
|---|
| <p><b>Pertussis (<i>Bordetella pertussis</i>) (Whooping Cough)</b><br/>2010 Case Definition CSTE Position Statement Number: 09-ID-51</p> <p><b>Case classification</b></p> <p><b>Probable</b><br/>In the absence of a more likely diagnosis, a cough illness lasting <math>\geq 2</math> weeks, with at least one of the following symptoms:</p> <ul style="list-style-type: none"><li>• paroxysms of coughing;</li><li>• inspiratory "whoop"; or</li><li>• post-tussive vomiting; AND</li><li>• absence of laboratory confirmation; and</li><li>• no epidemiologic linkage to a laboratory-confirmed case of pertussis.</li></ul> <p><b>Confirmed</b></p> <ul style="list-style-type: none"><li>• Acute cough illness of any duration, with isolation of <i>B. pertussis</i> from a clinical specimen; OR</li><li>• Cough illness lasting <math>\geq 2</math> weeks, with at least one of the following symptoms:<ul style="list-style-type: none"><li>○ paroxysms of coughing;</li><li>○ inspiratory "whoop"; or</li><li>○ post-tussive vomiting AND</li><li>○ polymerase chain reaction (PCR) positive for pertussis; OR</li></ul></li><li>• Illness lasting <math>\geq 2</math> weeks, with at least one of the following symptoms:<ul style="list-style-type: none"><li>○ paroxysms of coughing;</li><li>○ inspiratory "whoop"; or</li><li>○ post-tussive vomiting; AND,</li><li>○ contact with a laboratory-confirmed case of pertussis.</li></ul></li></ul> <p><b>Comment</b><br/>The clinical case definition above is appropriate for endemic or sporadic cases. In outbreak settings, a case may be defined as a cough illness lasting at least 2 weeks (as reported by a health professional).</p> |
|---|

An outbreak of pertussis is defined as two or more cases occurring within one incubation period of each other that are clustered in time and space (e.g., classroom, building, team, workplace), but are not household contacts.

Data pertaining to pertussis investigations are entered into the Virginia Electronic Disease Surveillance System (VEDSS), a statewide, electronic database used to track many reportable conditions. This system allows Virginia to transmit data on Probable and Confirmed

pertussis cases to the Centers for Disease Control and Prevention (CDC). More detailed information is reported to CDC through the Supplementary Pertussis Surveillance System.

The surveillance system is designed to capture all suspected cases of pertussis in Virginia; however, under-reporting occurs for several reasons. Some patients who suffer from pertussis do not seek medical attention; some may be misdiagnosed because their symptoms resemble other respiratory conditions; and still other cases may go uncounted by public health because they are treated before they meet the Probable or Confirmed case definition or because they are not tested with confirmatory methods. Rates of underreporting are estimated to be highest among adolescents and adults.

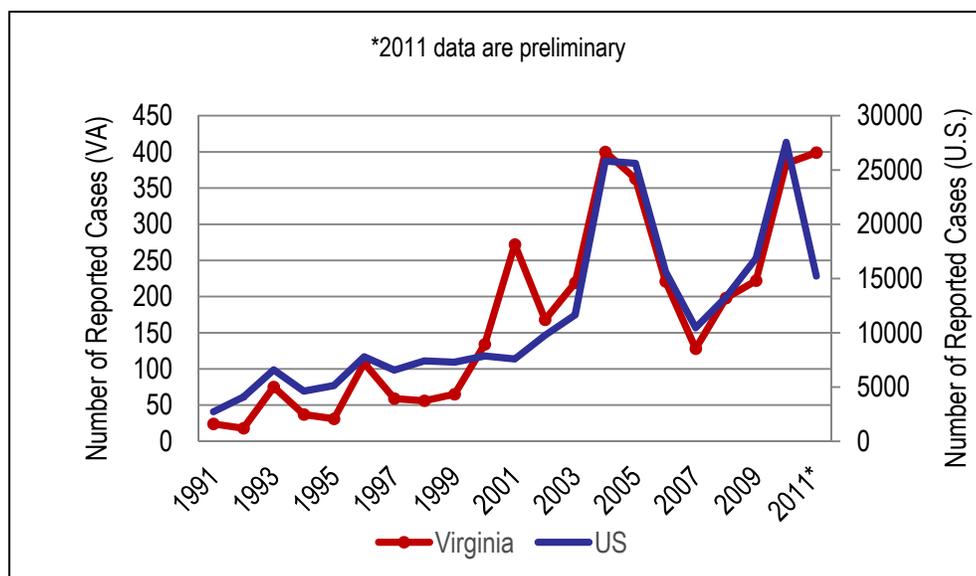
## EPIDEMIOLOGY

### Incidence

In the pre-vaccine era, pertussis was a common cause of morbidity and mortality among children in the United States. In the U.S., an average of 175,000 cases per year was reported during the 1940 – 1945 time period. After introduction of a whole-cell pertussis vaccine in the 1940s (DTP), the number of pertussis cases gradually declined. An average of 2,900 cases per year was reported during the 1980 -1990 time period (CDC, 2012).

Pertussis is endemic, and typically occurs in 3 to 5 year cycles. The cyclical nature of pertussis may reflect fluctuations in herd immunity. The protection conferred by pertussis infection and pertussis vaccines wanes, with varying estimates of its duration. After 5 to 10 years, persons are thought to be susceptible to infection or re-infection (CDC, 2006). The cyclical nature of pertussis is demonstrated in both the Virginia and U.S. trends shown on the graph below. Beyond periodic cycles, however, pertussis incidence has been increasing since the early 1980s.

Figure 2. Reported Pertussis Cases in the U.S. and VA, 1991-2011



Virginia has been on the upswing of a cycle since 2008, with 399 cases reported in 2011. This is the largest number reported since 2004, when 400 cases were reported, and more than 3 times the number of cases reported in 2007. The U.S. pertussis numbers for 2011 have not been finalized, but it appears that they may have peaked nationally in 2010, especially due to the large, statewide outbreak in California that year.

**Table 1. Pertussis Incidence in Virginia, 2007-2011**

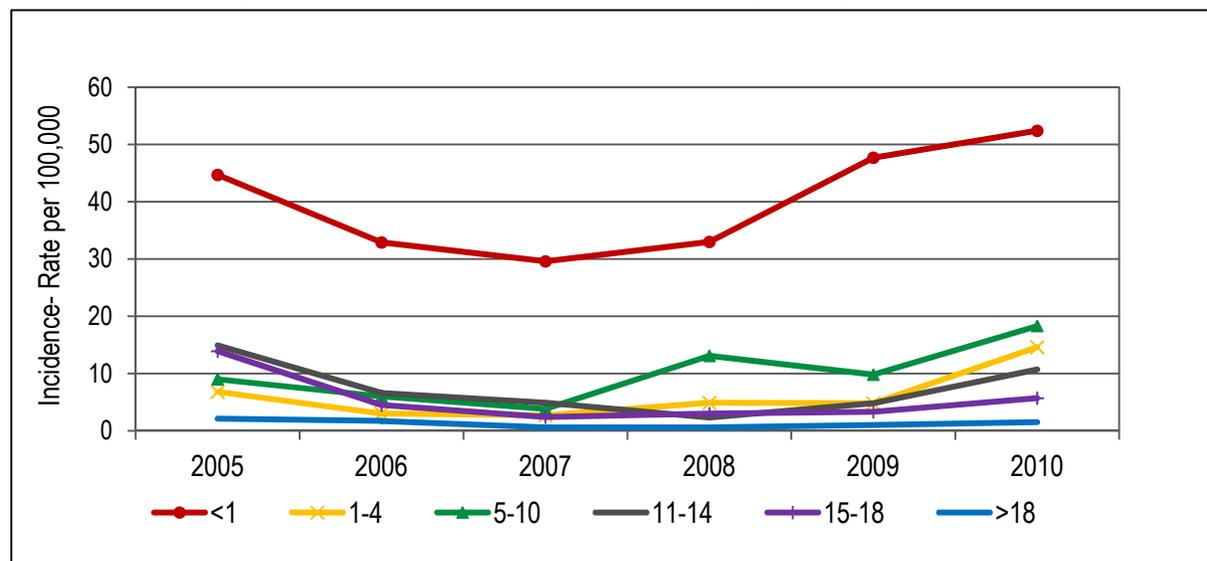
| Year  | Number of Cases | Rate per 100,000 | Number of Outbreaks |
|-------|-----------------|------------------|---------------------|
| 2007  | 128             | 1.65             | 6                   |
| 2008  | 198             | 2.55             | 9                   |
| 2009  | 222             | 2.82             | 10                  |
| 2010  | 384             | 4.87             | 10                  |
| 2011* | 399             | 5.06             | 13                  |

*preliminary*

*\*2011 data*

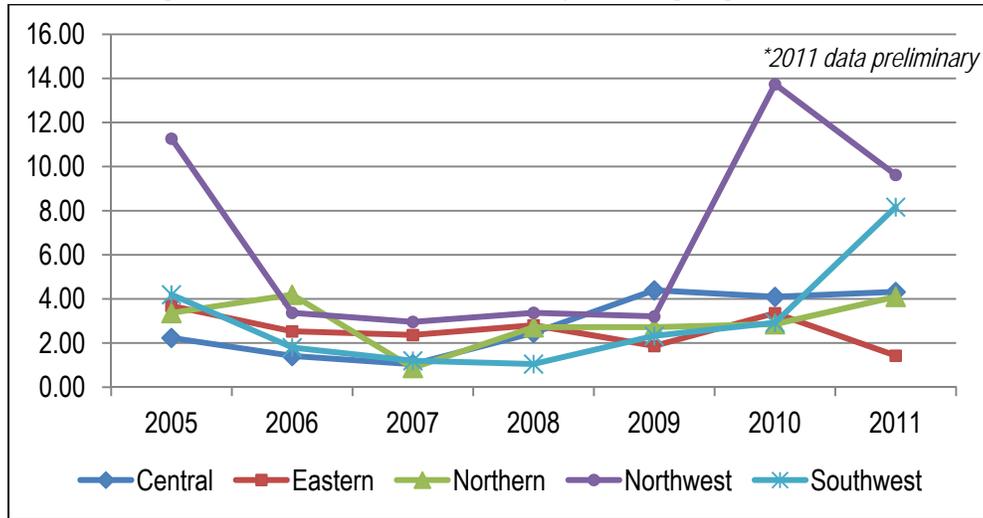
The number of reported cases is often highest in adolescents and adults; however, a different picture emerges when these numbers are adjusted for population. Incidence rates in Virginia are highest in the <1 year age group, followed by the 5-10 year age group and then the 1-4 age group (see Figure 2 below). Although infants do not account for the largest number of cases, they are disproportionately affected by pertussis based on their population. As expected, the highest incidence rates are in persons not completely protected by vaccination.

**Figure 3. Pertussis Incidence per 100,000 by Age Group and Year, VA 2005-2010**



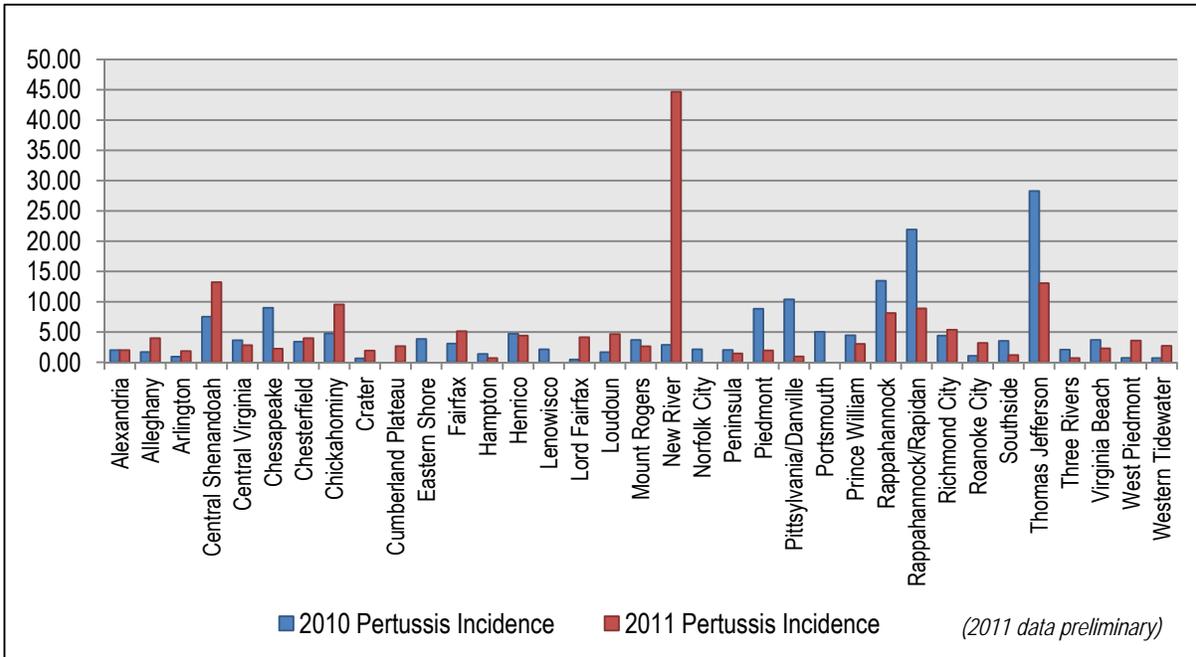
In terms of geographic patterns, incidence rates have been higher generally in the Northwest Region of the Commonwealth, but activity has been seen in every region (see Figure 3). The Northwest may have higher incidence rates because of pockets of susceptible children, a higher index of suspicion among providers in this region, a large medical system that does its own PCR testing and greater availability of testing.

**Figure 4. Pertussis Incidence Rates by Planning Region, VA, 2005-2011**



Incidence rates at the district and regional levels can vary widely year-to-year due to outbreaks and variability in reporting. District incidence rates for 2010 and 2011 are presented in Graph 4; note the large increase from 2010 to 2011 in New River’s incidence due to a school-based outbreak that illustrates the variability in rates by year.

**Figure 5. Pertussis Incidence Rates by Health District, Virginia 2010-2011\***



The increase in reported cases seen nationally and in Virginia may be due, in part, to increased provider awareness and diagnosis, better laboratory tests, wider availability of rapid laboratory testing (PCR), and a 1995 change in the case definition used to count cases. In 1995, the case definition for pertussis was expanded to include PCR-positive tests and epidemiologic linking of pertussis cases as confirmation criteria.

Also contributing to the increase is waning pertussis immunity from childhood vaccination among adolescents and adults. A 2010 study by Lavine et al. of vaccine-induced immunity determined a “disease free duration of 10.5 years,” but the study authors hypothesize that immunity has been “decreasing over time, possibly due to a rising force of infection through increased circulation.”

The increase in reported cases is concerning given the availability of effective vaccines, the societal and economic costs of the disease, and national *Healthy People 2020* goals that describe a target 10% reduction of pertussis in children <1 years and reduction in incidence in adolescents 11-18 years. Trends in Virginia and nationally indicated that sustained efforts are needed to meet the *Healthy People 2020* targets.

### **Morbidity and Mortality**

The percent of pertussis cases that result in death is higher among infants aged <6 months of age compared to the percentage among other age groups. National data from cases occurring 1997 to 2000 show the percent mortality approaches almost 1% or 1 in 100 for young infants, while for other age groups it is closer to 0.1 to 0.2 percent (CDC, 2011).

In Virginia between 2006 and 2010, 58.9% of infants <1 year with pertussis were hospitalized. Between 2000 and 2010, 85.7% (6/7) of pertussis-related deaths in Virginia were among infants <6 months of age. Ninety-one percent (91.2% or 177/194) of pertussis-related deaths in the U.S. between 2000 and 2009 were among infants <6 months of age. In 2010, the U.S. reported 22 pertussis-related deaths, of these deaths, 10 were aged <3 months from California.

**Table 2. Virginia Deaths Due to Pertussis, 2000-2010**

| Year         | Deaths # | Age       |
|--------------|----------|-----------|
| 2000         | 1        | <6 months |
| 2001         | 0        |           |
| 2002         | 1        | <6 months |
| 2003         | 1        | <6 months |
| 2004         | 1        | <6 months |
| 2005         | 1        | <6 months |
| 2006         | 0        |           |
| 2007         | 0        |           |
| 2008         | 1        | <6 months |
| 2009         | 0        |           |
| 2010         | 1        | >50 years |
| <b>Total</b> | <b>7</b> |           |

Clearly, the very young are the most vulnerable to morbidity and mortality due to pertussis. Information in the next section on sources of infection can help to shed light on disease prevention.

### **Sources of Infection**

Who is the source of infection for infants? Studies indicate that the source is often those closest to the infant, usually a household contact such as a parent or sibling who unknowingly serves as a disease reservoir.

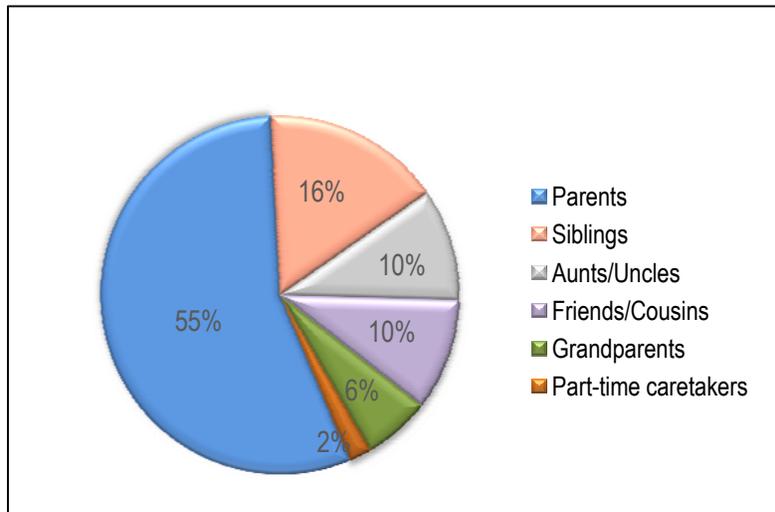
Recent studies have determined that 70% to 83% of infant pertussis cases can be traced to a source within the household (Bisgard et al., 2007; Hanson et al., 2011; Wendelboe et al., 2007). Bisgard et al's study determined that mothers are the most likely source, accounting for 32% of cases and other family members accounting for another 43%. Wendelboe et al (2007) also found that parents accounted for the majority of cases or 55%, followed by siblings with 16%, aunts and uncles 10%, friends/cousins 10%, grandparents 6% and part-time care takers 2% (See Graph 5). With similar findings on transmission sources, De Greef et al (2010) estimated that "35%-55% of infant cases could be prevented" if pertussis immunity were boosted or maintained in parents.

Parents are clearly an important transmission source, although another study by Jardine et al (2010) determined the most frequent transmission source for infants to be siblings (36%), followed by parents (24%), other family members (21%), friends (13%) and places outside the household such as medical settings (6%). Research suggests that nosocomial transmission is not as common as household transmission, but studies show that nosocomial pertussis outbreaks do occur (Baggett et al., 2007; Baugh and McCarthy, 2010).

Ensuring infectious family members and other caregivers avoid vulnerable infants is a challenge since most may be unaware that they have the disease. In a study of household outbreaks, Baptista et al (2010) determined that, although most of the adult cases had typical pertussis symptoms, "none had been diagnosed before the investigation." Misdiagnosis is common with pertussis infection, not only in adults with typical symptoms but especially in adults with mild or atypical symptoms. A study by Wendelboe et al (2007) suggests that "16% of infections in infants are the result of transmission of asymptomatic disease." Another study found that in persons 15 years and older, "asymptomatic infections were approximately 5 times more common than clinical illnesses" consistent with classic pertussis (Ward et al., 2006).

Because adults may not be aware they are infectious and may even be asymptomatic, vaccination is a key to preventing transmission. A recent study found that case households had a median of 3 Tdap age-eligible persons (at the time of study, persons 11-64 years) (Hanson, 2011). Another recent study modeling vaccination in neonatal intensive care units (NICU) determined that boosting healthcare workers' pertussis immunity "decreases the probability of secondary transmission from 49% to 2% (if 95% of healthcare workers are boosted), and decreases final outbreak size" (Greer and Fisman, 2009). Ensuring vaccination of age-eligible persons in an infant household and other settings is a significant step toward building a protective environment for the most vulnerable among us.

**Figure 6. Source of Pertussis Infection among Infants  $\leq$  6 months, by Role, Wendelboe et al, 2007**



### **Costs of Pertussis**

The morbidity and societal cost of pertussis is substantial. Persons with pertussis often make several visits seeking medical care and miss several days of school or work, often resulting in parents or caregivers missing work as well. Direct costs include physician and emergency department visits; laboratory tests and chest X-rays; prescription and non-prescription drugs; and hospital care. Indirect costs include but are not limited to child care, work disability and/or decreased productivity, and time associated with transportation to medical visits (Hay and Ward, 2005; Joint Commission, 2011).

The estimated cost of pertussis varies depending on the study used and costs included in the analyses. Generally, younger patients are at higher risk for hospitalization and longer hospitalizations stays, and are associated with higher total costs. A recent Dutch study found that infants disproportionately accounted for 50% of total pertussis costs per year (de Greeff et al., 2009). However, costly medical care occurs in patients across all ages.

O'Brien and Caro (2005) examined 1996-1999 hospitalization data on pertussis for four American states. The mean length of stay (LOS) for infants (<1 year) was "6 days at a cost of \$9,586 dollars per stay." As the age of the patient increased, the mean LOS decreased. Compared to infants, children (1-11 years) had a mean LOS of 3.7 days, and adolescents/adults had a mean LOS of 3.4 days. Children had a cost of \$4,729 dollars per stay, but adolescents/adults had a slightly higher cost of stay at \$5,683, but still less than infants (O'Brien JA and Caro JJ, 2005). Because this study examined only direct medical costs incurred during hospitalization, the dollar figures represent under-estimates of the true economic consequences of pertussis.

Examining the total direct and indirect costs of pertussis, a study by Pichichero and Treanor (1997) determined that 107 cases of pertussis in Monroe County, New York (reported 1989-1994) cost a total of \$381,052, with an overall average of approximately \$3,561 per case.

The cumulative number of lost workdays was 758 days. The mean full recovery time from pertussis illness was 72.9 days (range, 25-115 days) (Pichichero and Treanor, 1997). A similar study done for the same county, that focused on the family unit in a later time period determined “the average medical costs for an infant, child adolescent, and adult were \$2,822, \$308, \$254 and \$181, respectively” (Lee and Pichichero, 2000). The total mean cost of pertussis per family was \$2,115.

A study in Massachusetts assessed medical costs of confirmed pertussis during 1998-2000 and determined that adults with pertussis had mean medical costs of \$326, non-medical costs of \$447, resulting in a total cost of \$773, and missed a mean of 9.5 days of work (Lee et al., 2004). Compared to adolescents, adults had “significantly higher nonmedical costs.” Adolescents had mean medical costs of \$242 and non-medical costs of \$155, resulting in a total cost of \$397, with missed a mean of 5.5 days from school (Lee et al., 2004).

Though these studies include medical and non-medical costs, they do not include costs incurred by public health to identify and investigate pertussis cases. A CDC (2011) study of a 26-case, school-based pertussis outbreak in Nebraska determined a total cost of \$52,131 to public health, which included overhead, labor, travel and other costs. This averages to \$2,005 per case in the outbreak.

## **VACCINE RECOMMENDATIONS AND REQUIREMENTS**

### **Vaccine Recommendations**

The whole-cell pertussis vaccine was developed in the 1930s and was “used widely in clinical practice” by the mid-1940s. The vaccine was estimated to be 70%-90% effective in preventing serious pertussis infection. Concerns about safety led to the development of more purified (acellular) pertussis vaccines that are associated with a lower frequency of adverse reactions. Acellular vaccines were introduced in 1991, and by 1997, the ACIP recommended that all five doses of the vaccination schedule use DTaP rather than DTP.

DTaP is approved for use in children 6 weeks through 6 years (<7 years). The recommended schedule is doses at 2, 4, 6 and 15-18 months of age with a booster dose at 4-6 years of age. The efficacy after three doses is estimated to be 80%-85%. There are a variety of DTaP and combination vaccines currently available, including DTaP-Hep B-IPV (Pediarix), DTaP-Hib (Trihibit), DTaP-IPV-Hib (Pentacel) and DTaP-IPV (Kinrix).

In recognition that pertussis immunity waned sooner than expected, manufacturers developed the Tdap vaccine, first licensed by the Food and Drug Administration (FDA) in 2005. Estimates of its efficacy were based on bridging studies showing that Tdap vaccines produced similar or “non-inferior” levels of antibody compared to components of the DTaP vaccines. Antibody response to a single dose of Tdap is estimated to be “similar to that following three doses of DTaP in infants,” i.e., 80% to 85% (CDC, 2012). However, determination of vaccine efficacy in the field suggests a range from 65.6% to 92% (Ward JI, et al., 2005; Wei SC et al. 2010).

ACIP's 2006 recommendations for Tdap reflected goals that included protecting the vaccinated adolescent or adult, reducing the reservoir of *B. pertussis* and potentially reducing incidence in other age groups and settings. The 2006 recommendations were for a single, lifetime dose for adolescents 11-18 years of age, preferably at 11-12 years of age, to replace Td. A 5-year interval was recommended since the last dose of tetanus-containing vaccine, with shorter intervals allowed based on risk. For adults 19-64 years, the recommendation was a single dose of Tdap to replace Td if the last dose of tetanus-containing vaccine was received more than 10 years earlier, unless the adult had close contact with an infant <12 months of age (e.g., parents, child care providers, healthcare providers). If the adult was an infant close contact, a woman considering becoming pregnant, or healthcare worker with direct patient contact, the 2006 recommendation emphasized Tdap vaccination with an interval as small as 2 years since the last dose of tetanus-containing vaccine.

The 2006 recommendation stated "ideally, these adults [with infant close contact] should receive Tdap at least 2 weeks before beginning close contact with the infant," (CDC, 2006). By being vaccinated, close contacts of infants create a protective "cocoon" for newborns and infants who either cannot be vaccinated yet or have not completed their initial vaccine series. Cocooning is "a method of reducing pertussis transmission to newborns [and infants] by which household members and other caregivers (e.g., day care staff, health care personnel) are vaccinated." This strategy results in "herd immunity" and decreases, but does not totally eliminate, the risk of infants becoming infected with pertussis.

Two vaccines were available by 2006: Boostrix by GlaxoSmithKline approved for use in persons 10-18 years and Adacel by Sanofi approved for use in those 11-64 years. Boostrix expanded its FDA licensure twice, first in 2008 to those 19-64 years, and in 2011 to those 65 years and older. Boostrix is currently approved for use in persons 10 years of age and older.

Since the 2006 recommendations were made, significant revisions have been made to ACIP's guidance on Tdap use. Many of these changes occurred in 2011 and 2012, and reflect careful review of epidemiologic trends, as well as safety and immunogenicity data. These changes help to provide further protection for vulnerable infants and increase vaccination coverage.

ACIP now recommends use of Tdap in adults aged 65 years and older and under-vaccinated children ages 7 through 10 years, as well as giving Tdap regardless of the interval since the last tetanus- or diphtheria- containing vaccine. Tdap is now preferred during pregnancy if no prior Tdap dose has been administered, and providers are recommended to vaccinate their pregnant patients during the 3rd trimester or late 2nd trimester (after 20 weeks gestation). A summary of current ACIP recommendations is provided below in Table 3.

**Table 3. Summary of Current ACIP Recommendations**

| Age Group                              | Vaccine Type | Recommended Dosing Schedule  |
|--|--------------|--|
| Infants & Children [up to age 7 years] | DTaP         | Primary Series - 2, 4, 6, 15-18 months; booster - 4-6 years  |
| Children [age 7 through 10 years]      | Tdap         | Catch up – (or for unknown pertussis vaccine history) – May give single dose of Tdap in place of Td in the catch-up series   |
| Adolescents [age 11 to 18 years]       | Tdap         | Booster – Give single dose Tdap, preferably at age 11-12 years   |
| Adults [age 19 to 64 years]            | Tdap         | Booster – Give single dose of Tdap in place of Td, especially if in contact with infant age <12 months or healthcare worker with direct patient contact (e.g. parents, child care providers, nurses, physicians, etc.) |
| Adults [age 65 years and older]        | Tdap         | Booster – Give single dose of Tdap in place of Td, especially if in contact with infant age <12 months or healthcare worker with direct patient contact (e.g. grandparents, healthcare provider, etc.)                 |
| Pregnant women                         | Tdap         | Booster- For women who have not previously received Tdap, one Tdap booster preferably during the 3rd or late 2nd trimester (after 20 weeks gestation). Alternatively, administer Tdap immediately postpartum.          |
| Postpartum and breastfeeding women     | Tdap         | Booster – Give single dose of Tdap (if not received during pregnancy), preferably before discharge from hospital or birthing facility.   |

*Notes: Tdap recommendations apply to persons that have never received Tdap. Chart content based on: <http://www.cdc.gov/vaccines/vpd-vac/pertussis/recs-summary.htm>*

An ACIP provisional recommendation was published in March 2012 (Source: <http://www.cdc.gov/vaccines/recs/provisional/Tdap-feb2012.htm>) that essentially makes the Tdap booster dose a routine recommendation for all adults 19 years and older. The following updated recommendations were made:

- “For adults aged 19 years and older who previously have not received a dose of Tdap, a single dose of Tdap should be given.
- Tdap should be administered regardless of interval since the last tetanus or diphtheria toxoid-containing vaccine.
- Adults should receive a Tdap dose if the dose is recommended and no record of previous administration exists.”

Though these recommendations are provisional, they are likely to become official soon. Making the Tdap booster routine for all adults, regardless of the date of their last dose of tetanus-containing vaccine, helps simplify the recommendation and thus reduces barriers related to recall, age and risk factors.

### **Vaccination Requirements**

The Commonwealth of Virginia has requirements for pertussis vaccinations for attendance at daycare and school (both public and private) that are established through *The Code of Virginia* in §22.1-271.2 and §32.1-46. As with other vaccine requirements, unimmunized students can attend daycare or school if they have a medical or religious exemption.

For attendance at daycare, a nursery school or family daycare, DTaP doses are required as age-appropriate according to the ACIP schedule. For kindergarten and newly-enrolling 1<sup>st</sup> graders (school year 2011-12), 4 doses are required with one on or after the 4<sup>th</sup> birthday. The requirement for a dose after the 4<sup>th</sup> birthday became effective March 2010, and is a “rolling requirement” that stays with the cohort, and will affect newly-enrolling 2<sup>nd</sup> graders in the 2012-13 school year. “Newly-enrolling” means the student is new to the school or school district.

The Tdap requirement went into effect in 2006, and currently applies to students entering 6<sup>th</sup> grade, as well as newly enrolling 7-11<sup>th</sup> graders. However, the requirement is met if ≤5 years have passed since the student received a tetanus-containing vaccine.

Students enrolling full-time in public, four-year institutions of higher learning are required by *The Virginia Code* to be vaccinated against tetanus and diphtheria, “according to the guidelines of the American College Health Association (ACHA).” Although pertussis is not specified in the Code, the ACHA guidelines, updated in 2012, include one Tdap booster for all students 11-64 years and those aged ≥65 years who have contact with infants aged <12 months, regardless of the Td interval (ACHA, 2012). The guidelines also stress Tdap vaccination for students in healthcare settings. School and daycare entry requirements are summarized below in Table 4.

**Table 4. 2011-2012 School and Daycare Entry Requirements**

| Age or Group Setting   | Diphtheria, Tetanus and Pertussis Vaccination Requirement  |
|--|--|
| Childcare/Nursery School/Family Daycare, etc.  | 4 doses of DTaP, or as age appropriate according to ACIP   |
| Head Start 0-5 years   | 4 doses of DTaP, or as age appropriate according to ACIP   |
| Kindergarten, ~5-6 years   | 4 doses of DTaP, with 1 dose on or after the 4 <sup>th</sup> birthday  |
| 1 <sup>st</sup> -5 <sup>th</sup> grade, ~6-11 years  | <ul style="list-style-type: none"> <li>• 3-4 doses of DTaP</li> <li>• Newly-enrolling 1<sup>st</sup> graders need 4 doses of DTaP, with 1 d. on or after the 4<sup>th</sup> birthday</li> <li>• If &gt;7 years, only 3 d. of tetanus-containing vaccine are required if the 1<sup>st</sup> dose was given at ≥12 months</li> </ul> |
| 6 <sup>th</sup> grade, ~11-12 years  | <ul style="list-style-type: none"> <li>• 3-4 d. of DTaP; and</li> <li>• 1 dose of Tdap, if ≥5years since last dose of tetanus-containing vaccine</li> </ul>  |
| 7 <sup>th</sup> -12 <sup>th</sup> grade, ~12-18 years  | <ul style="list-style-type: none"> <li>• 3-4 d. of DTaP; and</li> <li>• Newly-enrolling 7-11<sup>th</sup> graders need 1 dose of Tdap, if ≥5years since last dose of tetanus-containing vaccine</li> </ul>   |
| Full-time students enrolled in public, 4-year institutions of higher learning in Virginia, ~18 years and older | <ul style="list-style-type: none"> <li>• Tetanus and diphtheria are specifically identified in <i>The Virginia Code</i>, not pertussis</li> <li>• ACHA recommends that the booster be given as Tdap</li> </ul>   |
| Adults, healthcare personnel, etc.   | Not required   |

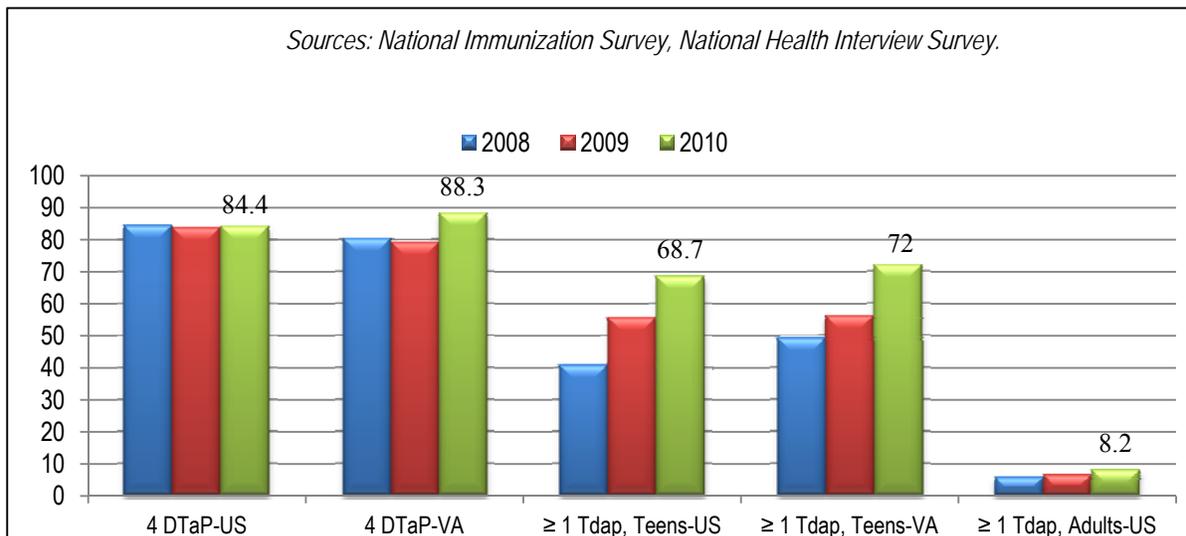
## VACCINATION COVERAGE

DTaP coverage rates among children are high both nationally and in Virginia. National Immunization Survey (NIS) data show coverage with four doses of DTaP (4DTaP) for children 19-35 months of age is 84.4% nationally and 88.3% in Virginia. Rates for four doses of DTaP had been falling prior to the 2010 data, possibly due to use of alternative immunization schedules with delayed doses and an increase in vaccination exemptions. The increase from 2009 to 2010 may be a sign that the message is getting out that the risk of pertussis infection is far worse than the theoretical risk from the vaccine.

Tdap coverage rates among teens are increasing both nationally and in Virginia. Nationally, 68.7% of teens 13-17 years had received a Tdap compared to 72.0% of teens in Virginia. The coverage rates are even higher when data from the 2010 Virginia Annual Immunization Survey is used: 92.7% of 6<sup>th</sup> grade students in Virginia have 1 Tdap at entry into 6<sup>th</sup> grade. Survey data indicate that 1.73% of combined 6<sup>th</sup> grade students have a medical or religious exemption.

Tdap coverage rates among adults are increasing, but still suboptimal. Data from the National Health Interview Survey indicate that 8.2% of adults nation-wide in 2010 had received Tdap. Data from prior years indicate that Tdap coverage is highest among those 19 to 24 years or college-aged. One potential reason is college entry immunization requirements. Tdap coverage among those with an infant in the household was 10.6% in 2010, and coverage among healthcare personnel is at 20.3%. Both of these numbers should be much higher, since ACIP recommendations date from 2006.

**Figure 7. DTaP and Tdap % Coverage, U.S. and VA, 2008-2010**



**Table 5. Adult Vaccination Coverage for Tdap, United States and Virginia**

| Characteristic                              | U.S.-2008 | U.S.-2009 | U.S.-2010 | VA- as of 4/18/12,<br>(VIIS population) |
|---|-----------|-----------|-----------|---|
| Total, 19-64 years                          | 5.9       | 6.6       | 8.2       | 16.7                                    |
| Ages 19-24 yrs                              | 8.1       | 8.4       | NA        | 18.8                                    |
| Ages 25-49 yrs                              | 5.8       | 6.9       | NA        | 14.9                                    |
| Ages 50-64 yrs                              | 4.7       | 5.4       | NA        | 18.5                                    |
| Persons with household infant <1 yr contact | 5.0       | 10.2      | 10.6      |   |
| Healthcare personnel                        | 15.9      | 17.0      | 20.3      |   |

In Virginia, 16.7% of adults aged 19-64 years in our immunization registry as of 4/18/2012 were documented as having received a dose of Tdap. A caveat to interpreting this number is that this rate is not a population-based number, but based on adults in the registry. To date, 2.6 million adults aged 19-64 years are in the Virginia Immunization Information System (VIIS) with at least one dose of any vaccine.

Why are rates not higher? A California survey of adult Tdap coverage found that, of those who had not received a Tdap dose, 66% said it was because they didn't know they needed it; it hadn't been recommended or no one told them to get it. This information underlines the need for educating the public, and involvement of trusted healthcare providers in recommending Tdap.

## **CHALLENGES TO ACHIEVING HIGHER COVERAGE RATES**

There are several important challenges to increasing vaccination coverage rates, including:

- Clinician's unfamiliarity with the latest (2012) ACIP recommendations, and possible discomfort with implementation of new vaccine recommendations
- Lack of awareness among the public and healthcare personnel about the latest Tdap indications for adults
- Barriers of cost and access to the vaccine, especially for adults
- Inadequate health insurance coverage of Tdap vaccine for adults
- Many adults may not have a regular healthcare provider or only see specialists, who may not routinely offer vaccinations
- Preventive care may not be a priority for adult patients or their specialists
- Individual belief that one's risk of pertussis infection is low, that pertussis (whooping cough) no longer circulates in Virginia or that protection from childhood vaccinations has not waned
- Concerns about vaccine safety from the public

- Questions about vaccine safety/need from healthcare personnel
- Concerns on the part of pregnant women and OB/GYNs to vaccinate with Tdap during pregnancy
- Barriers to vaccinate household/close contacts with Tdap before a newborn's hospital-discharge in a setting that is not the contacts' medical home
- Implementation of standing orders and possible cost barrier for use of Tdap over Td in emergency departments
- Occupational health policies that have not been updated to include the Tdap recommendation for healthcare personnel
- Increasing vaccine exemptions due to religious exemptions in children, impacting DTaP and Tdap coverage, though rates are still high.

### **Interventions to Achieve Higher Coverage Rates**

The following are a sample of vaccine-centered pertussis interventions.

#### **Kansas**

***Lessons Learned in Implementing a Cocoon Program to Prevent Infant Pertussis at Four Kansas Hospitals.*** March 2011. Elizabeth Lawlor, MS, Epidemiologist, Kansas Department of Health and Environment; Martha Siemsen. Presented at the 45<sup>th</sup> National Immunization Conference, Washington, D.C. Available:

<http://cdc.confex.com/cdc/nic2011/webprogram/Paper25496.html>

Tdap vaccine was provided by county health departments to three birthing hospitals with the goal of vaccinating postpartum women and one designated primary caregiver (parent, grandparent, childcare provider, etc) per newborn. This strategy included standing orders at the hospital to vaccinate the postpartum woman prior to discharge, in addition to a voucher redemption program for caregivers. Vaccination of postpartum women was achieved with vaccination rates above 80% during the first six months; the voucher program was changed to vaccination before discharge.

#### **Nevada**

***“Cocooning,” the Entire State of Nevada to Prevent Pertussis in Newborns and Young Infants.*** March 2011. Kathie Lloyd, MSN, RN, CNM, CNS, Immunization Special Projects Manager, Nevada State Health Division. Presented at the 45<sup>th</sup> National Immunization Conference, Washington, D.C. Available:

<http://cdc.confex.com/cdc/nic2011/webprogram/Paper25043.html>

The Nevada State Health Division (NSHD) and Nevada Immunization Coalitions wanted to create “cocooning” programs in all 18 birthing hospitals in Nevada to protect its youngest citizens from pertussis and influenza. Tdap vaccine was purchased by the State and administered by the hospital in two tiers: A) Health care workers involved in patient care of newborns to

infants less than 12 months and B) Mother and father or two significant others for every newborn. Hospitals were sent a “Cocooning” Tool Kit.

## **Texas**

***Implementation of Cocooning against Pertussis in a High-Risk Population (in a Houston Hospital)***. April 2010. C. Mary Healy, MD, Assistant Professor of Pediatrics, Baylor College of Medicine, Betsy H. Mayes, BSN, Marcia Rench, BSN. Presented at the 44<sup>th</sup> National Immunization Conference, Atlanta, Georgia. Available: <http://cdc.confex.com/cdc/nic2010/webprogram/Paper22776.html>

A Houston hospital implemented a cocooning program in a predominantly Hispanic, medically underserved, uninsured population. Phase I (January 2008-November 2009) provided postpartum Tdap, Phase II (June-November 2009) immunized infant caregivers on-site before infant hospital discharge. While practical and logistical barriers existed, Tdap cocooning was well accepted and successfully implemented in a high-risk population using standing orders and providing immunizations on-site.

## **The Joint Commission**

*Tdap Vaccination Strategies for Adolescents and Adults, Including Health Care Personnel: Strategies from Research and Practice*. 2011. The Joint Commission on Accreditation of Healthcare Organizations. Wortley, PM, Talbot TR, Rehm SJ, Fauerbach LL, eds. Illinois.

“Strongly Recommended Strategies” and “Recommended Strategies” for interventions to improve vaccine coverage rates among children, adolescents and adults (page 72):

- Strategies that increase community demand for immunizations
  - Client reminder or recall systems
  - Multi-component interventions, including education
  - School, day care and college-entry requirements
- Strategies that enhance access to vaccination
  - Reducing out-of-pocket costs
- Interventions that target providers
  - Reminder or recall systems
  - Assessment and feedback
  - Standing orders.

**APPENDIX A**  
**REFERENCES**

## APPENDIX A: REFERENCES

- American College Health Association (ACHA). Recommendations for Institutional Prematriculation Immunizations. 2012 April. Accessed: [http://www.acha.org/Publications/docs/ACHA\\_RIPI\\_Apr2012.pdf](http://www.acha.org/Publications/docs/ACHA_RIPI_Apr2012.pdf)
- Baggett HC, Duchin JS, Shelton W, Zerr DM, Heath J, Ortega-Sanchez, IR, Tiwari T. Two nosocomial pertussis outbreaks and their associated costs-King County, Washington, 2004.
- Baptista PN, Magalhaes VS, Rodrigues LC. The role of adults in household outbreaks of pertussis. *International Journal of Infectious Disease*. 2010 Feb; 14(2): e111-4.
- Baugh V, McCarthy N. Outbreak of *Bordetella pertussis* among oncology nurse specialists. *Occup Med (Lond)*. 2010 Aug; 60(5):401-5. Epub 2010 Apr 20.
- Bisgard KM, Pascual FB, Ehresmann KR, Miller CA, Cianfrini C, Jennings CE, Rebmann CA, Gabel J, Schauer SL, Lett SM. Infant pertussis: who was the source? *The Pediatric Infectious Disease Journal*. 2004 Nov; 23(11):985-9.
- Centers for Disease Control and Prevention. Preventing Tetanus, Diphtheria, and Pertussis Among Adults: Use of Tetanus Toxoid, Reduced Diphtheria Toxoid and Acellular Pertussis Vaccine. *MMWR*. 2006 Dec; 55(RR17):1-33.
- Centers for Disease Control and Prevention. Local health department costs associated with response to a school-based pertussis outbreak---Omaha, Nebraska, September-November 2008. *MMWR*. 2011 Jan; 14;60(1):5-9.
- Centers for Disease Control and Prevention. *Epidemiology and Prevention of Vaccine-Preventable Diseases*. Atkinson W, Wolfe S, Hamborsky J, eds. 12th ed., second printing. Washington DC: Public Health Foundation, 2012.
- de Greeff SC, Lugnér AK, van den Heuvel DM, Mooi FR, de Melker HE. Economic analysis of pertussis illness in the Dutch population: implications for current and future vaccination strategies. *Vaccine*. 2009 Mar 18;27(13):1932-7. Epub 2009 Jan 31.
- de Greeff SC, Mooi FR, Westerhof A, Verbakel JM, Peeters MF, Heuvelman CJ, Notermans DW, Elvers LH, Schellekens JF, de Melker HE. Pertussis disease burden in the household: how to protect young infants. *Clinical Infectious Diseases*. 2010 May 15;50(10):1339-45.
- Greer AL, Fisman DN. Keeping vulnerable children safe from pertussis: preventing nosocomial pertussis transmission in the neonatal intensive care unit. *Infect Control Hosp Epidemiol*. 2009 Nov; 30(11):1084-9.
- Hanson MP, Kwan-Gett TS, Baer A, Rietberg K, Ohrt M, Duchin JS. Infant pertussis epidemiology and implications for tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) vaccination: King County, Washington, 2002 through 2007. *Archives of Pediatric & Adolescent Medicine*. 2011 Jul; 165(7):647-52.

Hay JW, Ward JJ. Economic considerations for pertussis booster vaccination in adolescents. *Pediatr Infect Dis J*. 2005 Jun;24(6 Suppl):S127-33. Review

Jardine A, Conaty SJ, Lowbridge C, Staff M, Vally H. Who gives pertussis to infants? Source of infection for laboratory confirmed cases less than 12 months of age during an epidemic, Sydney, 2009. *Communicable Diseases Intelligence*. 2010 Jun;34(2):116-21.

Joint Commission (Joint Commission on Accreditation of Healthcare Organizations). *Tdap Vaccination Strategies for Adolescents and Adults, Including Health Care Personnel: Strategies from Research and Practice*. Wortley, PM, Talbot TR, Rehm SJ, Fauerbach LL. eds. Illinois: 2011.

Lavine J, Broutin H, Harvill ET, Bjornstad ON. Imperfect vaccine-induced immunity and whooping cough transmission to infants. *Vaccine*. 2010 Dec 10; 29(1)11-6. *Clin Infect Dis*. 2004 Dec 1;39(11):1572-80. Epub 2004 Nov 10.

Lee GM, Lett S, Schauer S, LeBaron C, Murphy TV, Rusinak D, Lieu TA, Massachusetts Pertussis Study Group. Societal costs and morbidity of pertussis in adolescents and adults. *Clin Infect Dis*. 2004 Dec 1;39(11):1572-80.

Lee LH, Pichichero ME. Costs of illness due to *Bordetella pertussis* in families. *Arch Fam Med*. 2000 Nov-Dec; 9(10):989-96.

O'Brien JA, Caro JJ. Hospitalization for pertussis: profiles and case costs by age. *BMC Infect Dis*. 2005 Jul 11;5:57.

Pichichero ME, Treanor J. Economic impact of pertussis. *Arch Pediatr Adolesc Med*. 1997 Jan;151(1):35-40.

Ward, J. I., et al. *Bordetella pertussis* infections in vaccinated and unvaccinated adolescents and adults, as assessed in a national prospective randomized Acellular Pertussis Vaccine Trial (APERT). *Clinical Infectious Diseases*. 2006 Jul; 43: 151-157.

Wendelboe AM, Njamkepo E, Bourillon A, Floret DD, Gaudelus J, Gerber M, Grimprel E, Greenberg D, Halperin S, Liese J, Muñoz-Rivas F, Teyssou R, Guiso N, Van Rie A; Infant Pertussis Study Group. Transmission of *Bordetella pertussis* to young infants. *The Pediatric Infectious Disease Journal*. 2007 Apr; 26 (4):293-9.

Wendelboe, A.M., et al. Estimating the role of casual contact from the community in transmission of *Bordetella pertussis* to young infants. *Emerging Themes Epidemiology*. 2007 Oct; 4:15.

Wendelboe AM, Van Rie A, Salmaso S, Englund JA. Duration of immunity against pertussis after natural infection or vaccination. *Pediatric Infectious Disease Journal*. 2005;24: S58--S61.

**ATTACHMENT 1**

**HCPPTF AND SPECIAL PROJECT TDAP INITIATIVE  
SUMMARY OF ACCOMPLISHMENTS  
as of 5/31/2012**

# Health Commissioner's Pertussis Prevention Task Force (HCPPTF) and Special Project Tdap Initiative

## Summary of Accomplishments as of 5/31/2012

### Contents

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- Morbidity Update-Pertussis in Virginia
- Pre-Task Force Activities
- Special Project Tdap Vaccine Distribution and Administration (to LHDs and Free Clinics)
- Pertussis Prevention Activities and Vaccine Promotion (Central Office, Task Force Members, LHDs)

### VDH Pre-Task Force Activities

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Since Tdap's licensure in 2005 and ACIP recommendations in 2006, the Virginia Department of Health has been active in promotion of its use.

- Local health departments provide school-required Tdap for rising 5th graders –through LHD clinics and school-based Tdap clinics
- Virginia Vaccines For Children: VVFC-eligible patients aged  $\leq 18$  years can receive DTaP and Tdap for free at local health departments (LHDs) and enrolled private providers.
- ARRA (American Recovery and Reinvestment Act) provided funding for vaccines, starting 4/30/2010 and ending in 2011. Under ARRA, districts were able to order free Tdap to administer to anyone for whom it was indicated.
  - 29,670 doses of free, mostly ARRA-funded Tdap doses were administered to those 15-64 years, fiscal year 2010, by local health departments.
  - Several districts developed special initiatives surrounding the Tdap vaccine available through ARRA.

### Special Project Tdap Vaccine Distribution and Administration

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Special Project Tdap vaccine was shipped to local health departments (LHDs) in early August 2011. The vaccine is being targeted toward uninsured and underinsured adults, with priority candidates including:

- Adults—who are parents, grandparents, or other adult household contacts or caregivers of infants less than 12 months of age
- Pregnant women in third or late second trimester (after 20 weeks)
- Postpartum women with infants
- Health care workers who care for infants
- Child care workers who care for infants.

## Local Health Departments

Doses distributed: 40,660 doses of Tdap  
Doses administered: 24,661 doses of Tdap (as of 4/30/2012)  
Doses administered represents doses given to adults 19 years and older by LHDs since 7/1/2011

## Free Clinics and Beyond

23 Free Clinics through the Virginia Association of Free Clinics received vaccine  
Doses distributed: 2,940 doses  
Doses administered: 513 doses (as of 5/20/2012)  
They represent a variety of different geographic regions  
Doses administered will be provided using VIIS, the immunization registry, or faxed monthly forms

## Pertussis Prevention Activities and Vaccination Promotion

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### Central Office – *by date*

The Division of Immunization conducted a **Hospital Survey** on Influenza and Tdap Vaccination Policies 10/17/11-10/28/11, sending a survey tool online and through email to 85 infection preventionists (IPs) in acute care, critical access and children's hospitals throughout Virginia. Though the response rate was 36.5%, the data suggest that the majority of hospitals have influenza and Tdap vaccination recommendations in place, with smaller numbers having either no policy or a mandatory policy. The data suggest that there is work to be done in providing hospitals with tools and education to bring standards of care up-to-date.

Health Commissioner Dr. Karen Remley and staff from the Division of Immunization worked with the AARP to provide data and quotes for an **article featured in the AARP bulletin** and AARP website on the importance of older persons and especially grandparents receiving their Tdap booster for pertussis prevention. The 11/1/2011 article was entitled "Grandparents Urged to Get Booster Shot to Protect against Pertussis," and is available at: <http://www.aarp.org/relationships/friends-family/info-11-2011/grandparents-need-whooping-cough-vaccine-va.html> .

Dr. Karen Remley in conjunction with the Eastern Region Tdap Taskforce and the Office of Epidemiology has developed a **Superintendent Letter** for school systems that encourages Tdap vaccination of teachers and school personnel.

The Division of Immunization and Dr. Laurie Forlano developed a **peer-to-peer letter** endorsing use of the current ACIP recommendations for Tdap use. VDH along with the Virginia chapters of the AAP, AAFP, ACOG, VACEP, and ACP signed the letter (12/2011). The letter is featured on VDH's Pertussis Prevention webpage (see below).

The Division of Immunization adapted a variety of **Tdap and pertussis prevention flyers** (one-page, colorful fact sheets) from other states, including California and Michigan, for VDH's use in educating healthcare personnel, new moms, parents, grandparents and others regarding the importance of Tdap vaccination and cocooning infants.

The Department of Medical Assistance Services (**DMAS**) and The Centers for Medicare & Medicaid Services (**CMS**) provided information on coverage of Tdap for adults as follows:

- **Medicaid:** The State Plan says that the only vaccines [DMAS] pays for non-EPSTD are flu and pneumonia. Medicaid sometimes pays for a vaccine such as Tdap if a physician determines medical necessity and uses modifier 22 and attaches notes to prove medical necessity.
- **Medicare Part D:** Tdap vaccine is a Part D covered drug for ages 65 years and older. Tdap vaccine may be obtained by Medicare Part D beneficiaries from a network pharmacy. Tdap also may be provided in a network provider's office, which requires the beneficiary to pay for the vaccine costs up front and then be reimbursed by their Medicare Part D plan.
- **Medicare Part B:** Tdap is not covered by Medicare Part B even as part of treatment for an injury. Only Tetanus is covered (possibly not even Td).

A **Pertussis Prevention webpage** is now featured on the Division of Immunization's homepage and the VDH homepage (1/6/2012). The page features a variety of prevention resources for individuals and families as well as healthcare providers, including current ACIP recommendations for vaccination, adapted Tdap flyers, standing orders and other resources and tools.

The Division of Immunization staff and Dr. Forlano developed three **Frequently-Asked-Questions (FAQ) documents**, based on Chesapeake's clinician letter, that provide information on Tdap administration and insurance coverage for both the general public and clinicians. The finalized FAQs are featured on the Division of Immunization's Pertussis Prevention webpage.

## **Task Force Localities**

### **Chesapeake Health Department**

Chesapeake HD has developed several educational tools for providers as well as the public. The district sent a "Show a Child You Care" document and Tdap flyer to local daycare providers by hot fax. Healthcare providers and acute care centers received "The What Health Care Reform Means for Vaccines" by hot fax as well. Also developed were: a Doctors-Patient Card, Cocooning Fact sheet, Dear Chesapeake Physicians letter, Share your Love (Michelle Charters/PIV document), and Show a Child You Care. Many of these documents are also available in Spanish.

- 11/1/11 Dr. Kulberg gave a presentation to Chesapeake Regional Medical Center OB at the department meeting. Also, she met with 3 key nurse managers (L&D/Mother baby/nursery), and gave them packets of the above information.
- Nurses: all received the above plus the Pertussis Info Sheet
- 1/29/12 Dr. Kulberg will present a lecture at the VAFP (VA Academy of Family Physicians Annual Winter Meeting (200-300 physicians usually in attendance)
- Dr. Kulberg is the liaison to VAFP, coordinating with VAFP signing of the Health Commissioner Letter to VAFP membership.

## Prince William Health Department

Prince William HD partners with Hospital for Pertussis CME Event: Close to 200 physicians, nurses and health care personnel attended a special Pertussis Medical Grand Rounds continuing education training at Prince William Hospital on January 20. A joint partnership between the Prince William Health District and the hospital, the “working lunch” featured UVA Associate Clinical Professor of Family Medicine David S. Gregory, MD, FAAP, who discussed “Immunizing Adolescents & Adults Against Pertussis: What All Physicians & Nurses Should Learn from Recent Infant Deaths.” Helping underscore the meeting’s core message of awareness and immunization, Prince William Hospital’s Occupational Health unit provided 65 free Tdap vaccinations to its employees after the presentation. The event has also sparked an ongoing discussion between health care providers and hospital administration about acquiring and providing Tdap to eligible patients. Prince William Hospital recently revised their immunization protocols and they are now providing Tdap in their maternity ward and Emergency Department facilities.

### Task Force Members

Dr. Michael Ashby conducted a **survey** 9/1/2011- 9/12/2011 of primary care physician in the Martha Jefferson Hospital system, to assess attitudes toward Tdap vaccination. The data from 56 responders indicated that the majority were familiar with and supportive of Tdap vaccination. Progress is being made with obstetricians and Emergency Departments, as well as Employee Health with regard to Tdap use.

Laura Lee Viergever with the Virginia Health Plans **surveyed** the health plan members in her association, with a response rate of 70%. She reported verbally that, under health-care reform, Tdap vaccination will be covered. Prior to reforms, the health plans may or may not cover it, but that the vaccine is likely covered if administered in a networked provider’s office. Approximately half of the plans cover the Tdap vaccine in a pharmacy setting.

PIV (Project Immunize Virginia) has developed a **variety of Tdap and pertussis prevention flyers** that can be adapted by healthcare providers or health departments that target new parents, as well as different demographics, such as Spanish speakers and minorities. Flyers are posted on the PIV website, which is can be accessed from the Division of Immunization’s homepage.

PIV’s Advocacy Work Group worked with the Sports Medicine Advisory Committee (SMAC) and the Virginia High School League (VHSL) to amend the high school **sports physical form** to include Tdap as an option for vaccination of teen athletes. The new form will be released in the spring of 2012. This change will serve as a reminder to both parents and healthcare providers that Tdap is the vaccine that is received and desired.

Dr. Holly Puritz, Vice Chair of the Virginia chapter of ACOG (American Congress of Obstetricians and Gynecologists), sent a **blast email to all members** (1/9/2012). The blast email included a letter about the importance of Tdap vaccination, the latest Tdap recommendations, and mention of VIIS, the immunization registry, to help locate patients’ immunization records.

## Local Health Department Promotion- *Activities since 9/1/2011*

The immunization contacts at each Health District (35) were requested to provide updates via quarterly reports to the Division of Immunization on Tdap clinics and promotional activities. The following is a summary of received reports, as of 4/26/2012 (*the data is subject to change*).

### Special Clinics

- 190 total special clinics were held involving Special Project Tdap vaccine, including 147 off-site and 43 other special clinics
- 30 Health Districts held special clinics, with between 1-24 total special clinics per district
- Many clinics listed as 'other' were held in conjunction with WIC clinics or influenza vaccination clinics. Many districts are offering Tdap vaccine in WIC, Family Planning, Immunization and Maternity clinics.
- Special clinics were held at a variety of locations, including schools, daycares, social services, parental classes (e.g., car seat training), libraries, work places, festivals, health fairs, malls, fire stations, colleges, homeless shelters, soup kitchens and churches.

### Presentations

- 55 total presentations were made, with a total attendance of 4,395 persons
- 16 Health Districts gave presentations, with between 1-15 presentations per district and with 10-3,000 audience members per presentation
- Presentations were given to a variety of audiences/settings including daycare providers, new parents, school staff, physicians' offices, group homes, city leaders and the Hispanic community.

### Media Events, Flyers and Other Tools

- 19 total media events occurred, using Print (12), TV (4), Other (1) and Radio (2)
- 10 Health Districts were involved in media events, with 1-2 media events per district
- 27 tools were developed, including flyers, posters, brochures, letters, slides, questionnaires and fact sheets
- 16 Health Districts were involved in developing tools for use in Tdap promotion

### Other Activities of Interest

- Storefront window display at the mall
- Showing a DVD in LHD waiting rooms
- MPH student partnered with LHD for a cocooning project
- Using Tdap "coupons"
- Developing a 'toolkit' or pertussis packet for medical providers