disease prevention news

DPN

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Cost of Pertussis Hospitalizations in Texas, 1994

Background

Pertussis is a highly contagious, upper respiratory illness with symptoms that can linger for 6 to 10 weeks. The disease typically begins with catarrhal symptoms indistinguishable from those produced by other respiratory infections. The catarrhal phase is followed by a dry, nonproductive cough which usually evolves into paroxyms of expiratory bursts followed by an inspiratory gasp (the characteristic high-pitched "whoop"). Leukolymphocytosis is common; the white blood cell count may exceed 50,000 cells per cubic millimeter.

Compared with children, adolescents and adults infected with *Bordetella pertussis* usually have a milder disease. In these persons, pertussis may appear as a mild upper respiratory tract infection with an unusually persistent cough.

Infants are at highest risk of complications or hospitalization from pertussis. Because very little transplacental immunity is conferred on infants, they are susceptible to pertussis in the first few months of life when mortality due to pertussis is highest. Nationally, in 41% of all reported pertussis cases, the patient is hospitalized. Of infants with pertussis, 69% are hospitalized.

Until diphtheria tetanus pertussis (DTP) vaccine became available in the mid-1940s, pertussis was a common childhood illness in the US. Widespread use of this vaccine has reduced pertussis incidence nationwide from over 200,000 cases in 1940 to 4,617 reported in 1994 (a 99% decrease). DTP also has markedly changed the age distribution of pertussis in the US. Prior to DTP licensure, approximately 20% of pertussis cases occurred in infants younger than 1 year old and about 60% in children 1 to 4 years of age. More recently, however, a greater proportion of cases occurred in infants younger than 1 year of age. From 1989 through 1991, infants younger than 1 year old comprised 45% of all pertussis cases nationwide.

By Texas law, health care providers must immediately report every suspected pertussis case to TDH. The report must include the name, date of birth, sex, race/ethnicity, telephone number, and address of the patient; and the date of disease onset, method of diagnosis, and name of diagnosing physician. Through passive surveillance of these reports, the TDH Immunization Division's Surveillance, Epidemiology, and Assessment (SEA) Program col- lects epidemiologic data on all suspect cases of pertussis occurring in Texas.

The 1994 total was 160 cases of pertussis reported in Texas, with 89 patients hospitalized. Infants under 1 year old comprised 66% (106) of all pertussis cases, and 67% of these infants were hospitalized. By contrast, only 33% of pertussis patients 1 year of age and older were hospitalized.

Given the availability of an effective vaccine for the prevention of pertussis, many hospitalization costs due to pertussis can be avoided. To quantify the costs of illness versus the costs of prevention in Texas, the TDH SEA Program analyzed hospitalization costs for reported pertussis cases in 1994.

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Methods

On February 15, 1995, letters requesting billing data were sent to each hospital where a patient with confirmed or probable pertussis had been hospitalized in 1994. A second letter was mailed on April 21, 1995, to hospitals that did not respond to the initial request. Data regarding pertussis cases and hospital charges were collected and analyzed using EpiInfo and CDC's National Electronic Telecommunication System for Surveillance (an EpiInfo application).

Results

Billing information was received for 73 cases, for a response rate of 81%. Cumulative charges for the 73 pertussis cases amounted to $742,372. The hospital charges for patient care ranged from $136 to $240,695, with a mean charge of $10,169 and a median charge of $4,004. The patient whose hospitalization charges were $240,695 was a 2-month-old unvaccinated infant with tachypnea, pneumonia, and severe respiratory distress. This infant required ventilation. Since this hospitalization charge was significantly higher than the others, median information has been included for all areas affected by this cost outlier.

Incidence rates varied among ethnic groups. The race-specific incidence rate for pertussis was more than twice as high for Hispanics (1.46 per 100,000) as it was for non-Hispanic whites (0.69 per 100,000). Hospitalization rates and charges across race and ethnicity, however, were very similar. Hospitalization rates were similar among Hispanics and non-Hispanic whites, 55% and 54% respectively. The mean hospitalization charge for non-Hispanic whites was $7,758. Hospitalization charge for Hispanics averaged $12,845 (median $3,668).

Of the 73 hospitalized patients for whom billing information was obtained, only 21 had received all recommended DTP vaccinations for their ages; 14 had not received all recommended DTP vaccinations for their ages; and 38 had received no pertussis vaccine. Of the 38 patients, 26 were too young to receive DTP vaccine. Hospitalization costs for those unvaccinated with DTP were $491,709, or $12,940 per patient (median $4,120). The 14 patients who were inadequately vaccinated had hospitalization charges of $85,914, or $6,137 per case (median $3,667). Patients with up-to-date vaccine status had hospitalization charges of $164,749, or $7,845 per patient ($3,391).

Discussion

Since pertussis can be a serious illness in infants, and a greater proportion of cases is now occurring in this population, it is important to make sure that infants are vaccinated on schedule and, therefore, protected. AAP, ACIP, and TDH recommend that infants begin their DTP vaccinations at 2 months of age and receive subsequent doses at 4, 6, and 12 months of age; and a final booster dose at 4 to 6 years of age. The efficacy of 3 or more doses of pertussis vaccine has been estimated to be 70% to 90%.

Because unvaccinated and undervaccinated children older than 2 months of age are not fully protected against pertussis, they are more susceptible to disease.[1,2] Therefore, for the purposes of this analysis, pertussis cases in this cohort are considered preventable.

The following facts demonstrate the public health impact of failure to immunize the 23 children in this study who contracted pertussis in 1994. A dose of DTP vaccine cost $8.89 in 1994. Proper vaccination of these 23 children would probably have saved hospitalization costs of

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$116,139: the approximate cost of 13,064 doses of DTP vaccine (enough to fully vaccinate 2,612 children). In turn, it is estimated that these 23 pertussis patients could have been fully vaccinated with DTP for a mere $1,022. This analysis does not take into consideration additional medical and societal costs, such as time lost from work or school, associated with pertussis illness.

This analysis of pertussis hospitalization charges clearly shows that treating this disease is far more costly than preventing it. Pertussis vaccination has been shown to be safe, effective, and highly affordable. Given the potential severity of pertussis illness in infants, it is critical that children be vaccinated on schedule to ensure maximum protection at the earliest possible age.

References

1. Atkinson W, Gantt J, Mayfield M, Furphy L, Epidemiology and Prevention of Vaccine-Preventable Diseases. US Department of Health and Human Services, 1995.

2. Plotkin S, Mortimer E. Vaccines. WB Saunders Company, Philadelphia, 1994.

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Did you know?

Texas had more than 1,800 cases of pertussis reported in the last 10 years.

Many patients with clinical symptoms are not tested for pertussis.

By Texas law, all health care providers must report suspected cases of pertussis to the Texas Department of Health immediately.

Pertussis Control Measures

- All reports of suspected pertussis cases should be investigated promptly and reported to the local health authority.
- Identify all exposed contacts.
- Erythromycin prophylaxis (40-50 mg/kg/day, orally in 4 divided doses; maximum, 2g/day) for 14 days, as tolerated, is recommended for all household contacts and other close contacts, such as those in child care, **irrespective of vaccination status**. For those who cannot tolerate erythromycin, trimethoprim/sulfamethoxazole is an alternative.
- Exposed contacts should be observed for 14 days after last contact with the infected person.
- Close contacts younger than 7 years who are unimmunized or who have received fewer than 4 doses of the diphtheria, tetanus, and pertussis combined vaccine (DTP) should have vaccination initiated or continued according to the recommended schedule. Children who received their third dose 6 months or more before exposure should be given a fourth dose at this time. Those who have had at least 4 doses of DTP should receive a booster dose of DTP or DTaP (diphtheria and tetanus toxoids combined with acellular pertussis) unless a dose has been given within the last 3 years or they are more than 6 years old.

More pertussis facts on page 6 ☞

Vaccine Contraindications

ALL

True Contraindications
- History of anaphylactic reaction to a vaccine (Do not give that particular vaccine.)
- History of anaphylactic reaction to a vaccine component (Do not give any vaccine containing that substance.)
- Moderate or severe illnesses with or without a fever

Vaccines may be given
- History of a mild to moderate local reaction (soreness, redness, swelling) following a dose of an injectable antigen
- Mild illness with or without low-grade fever
- Current antimicrobial therapy
- Convalescent phase of illness
- Prematurity (same dosage and indications as for normal, full-term infants)
- Recent exposure to an infectious disease
- History of penicillin or other nonspecific allergies or family history of such allergies

DTP OR DTaP

True Contraindications
- History of encephalopathy within 7 days of receiving a prior dose of DTP

Precautions
- History of fever ≥40.5°C (105°F) within 48 hours after receiving a prior dose of DTP
- History of collapse or shock-like state (hypotonic-hyporesponsive episode) within 48 hours of receiving a prior dose of DTP
- History of seizures within 3 days of receiving a prior dose of DTP
- History of persistent, inconsolable crying lasting ≥3 hours within 48 hours of receiving a prior dose of DTP

Vaccines may be given
- History of fever ≤40.5°C (105°F) following previous dose of DTP
- Family history of convulsions (consider giving acetaminophen before DTP or DTaP and after every 4 hours for 24 hours)
- Family history of sudden infant death syndrome
- Family history of an adverse event following DTP administration

OPV

True Contraindications
- History of infection with HIV or a household contact known to be infected with HIV
- History of immunodeficiency (ie, hematologic and solid tumors; congenital immunodeficiency; and long-term immunosuppressive therapy)
- Household member/s with history of immunodeficiency

Precaution
- Pregnancy

Vaccines may be given
- Breastfeeding
- Current antimicrobial therapy
- Diarrhea

IPV

True Contraindications
- History of anaphylactic reaction to neomycin or streptomycin

Precaution
- Pregnancy

MMR

True Contraindications
- History of anaphylactic reaction to egg ingestion or to neomycin
- History of immunodeficiency (eg, hematologic and solid tumors; congenital immunodeficiency; and long-term immunosuppressive therapy)
- Pregnancy

Precaution
- Recent receipt of blood products or IG

Vaccines may be given
- Tuberculosis or positive PPD
- Simultaneous TB skin testing (postpone TB skin test 4 to 6 weeks if not administered simultaneously with MMR)
- Breastfeeding
- Pregnancy of mother of recipient
- Immunodeficient family member or household contact
- Infection with HIV
- Nonanaphylactic reactions to eggs or neomycin

VARICELLA

True Precautions
- History of anaphylactic reaction to neomycin
- Immunodeficiency or long term immunosuppressive therapy
- Pregnancy

Precaution
- Recent receipt of blood products or IG

Recommended Immunization Schedule: All Vaccine-Preventable Diseases

	Age					
At Birth	**2 Months**	**4 Months**	**6 Months**	**12-15 Months**	**4-6 Years**	**Every 10 Years**
Hepatitis B	Hepatitis B DTP/Hib Polio	DTP/Hib Polio	Hepatitis B DTP/Hib Polio	DTP/Hib MMR Varicella*	DTaP/DTP Polio MMR	Td

DTP/Hib = diphtheria, tetanus, pertussis, and *Haemophilus influenzae* type b
DTaP = diphtheria, tetanus, and acellular pertussis
MMR = measles, mumps, and rubella
Td = tetanus and diphtheria
* Varicella to be given at 12-18 months.

Pertussis Fact Sheet

Transmission: Pertussis is transmitted primarily by inhilation of airborne discharges from respiratory mucous membranes of infected persons.

Clinical Case Definition: A cough illness lasting at least 2 weeks with one of the following: paroxysms of coughing, inspiratory whoop, post-tussive vomiting - and without other apparent cause (as reported by a health professional).

Case Classifications

- **Confirmed:** A clinically compatible case that is laboratory-confirmed or epidemiologically linked to a laboratory-confirmed case.

- **Probable:** Meets the clinical case definition, is not laboratory confirmed, and is not epidemiologically linked to a laboratory-confirmed case.

*Report all suspected pertussis cases immediately to the local or regional health department at **(800) 705-8868** or to the Texas Department of Health (TDH) Immunization Division in Austin at **(800) 252-9152**.*

Investigation Form: Local and regional health departments ARE REQUIRED to submit this form on all probable and confirmed cases.

Preferred Laboratory Confirmation: Isolation of *Bordetella pertussis* from clinical nasopharyngeal specimen (i.e. culture). A special growth medium is required. To obtain the required Regan-Lowe (RL) transport medium kits or direct fluorescent antibody (DFA) kits, contact the TDH Bureau of Laboratories, Support Services Division, at **(512) 458-7318**. (Keep in mind the 3-month shelf life of RL medium.) Contact the TDH Immunization Division at **(800) 252-9152** prior to submitting specimens for laboratory testing.

Specimen Collection/Preparation Guidelines (for both culture and DFA preparation)**:** Wear a mask for protection. During the catarrhal or early paroxysmal stage, collect a nasopharyngeal specimen from each nostril with either a thin-wire calcium alginate or Dacron swab. Gently pass the swabs through the nares as far as possible into the posterior nasopharynx and rotate a few turns before withdrawing them. DO NOT force the swab past obstruction. If resistance is met in both nasal passageways, enter the nasopharyngeal area through the mouth.

- **Culture Media Inoculation:** Keep the RL transport medium, with screw caps tightened, refrigerated until use. DISCARD MEDIUM AFTER THE EXPIRATION DATE PRINTED ON THE TUBE and request new sets of RL media for each unused kit. Roll the 2 swab specimens across the **slanted** surface of one RL transport slant. Place the 2 swabs into 1 RL Transport Deep, pushing the swab down into the medium. Cut off the shaft of the swabs at the top of the tube. Replace cap. Write patient name on each tube, tighten screw caps, wrap each tube in a paper towel, and place the wrapped tubes in the screw-capped aluminum cylinders.

-- OR --

- **DFA Slide Preparation:** Label each slide with patient's name. Using a plastic transfer pipette, transfer one drop of sterile distilled water to each circle of the fluorescent antibody (FA) slide. Apply the specimen taken from one nostril to one circle on the slide. Swirl the swab in the drop of fluid to mix well. Repeat this procedure using the swab from the other nostril and transfering this second specimen to the second circle of the same slide. DO NOT fix the slide with heat. Allow slide to air dry thoroughly and place in plastic mailer. ***Note:*** *Because DFA testing of nasopharyngeal secretions has been shown in some studies to have low sensitivity and variable specificity,* ***it should not be relied on as the sole criterion for laboratory confirmation.***

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Labeling and Shipping Instructions

- Use form G-1, Specimen Submission Form, for each set of RL transport tubes and each FA slide. Include name and telephone number of the physician or laboratory contact person.
- Transport the specimen(s) to the lab as soon as possible. If there is a delay of more than 2 hours between collection and shipment, please refrigerate.
- Send specimens on wet ice (cold packs).
- Ship specimens so that they are received within 48 hours of collection.

Send specimens to

Bacteriology
Bureau of Laboratories
Texas Department of Health
1100 West 49th Street
Austin, TX 78756

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Majority of 1994 Deaths Were Preventable

The correlation between longevity and optimal health care/safety practices is underscored by recently released 1994 birth and death figures from the Bureau of Vital Statistics of the Texas Department of Health (TDH).

The leading cause of death in 1994 for all Texans continued to be heart disease, responsible for 30.6% of all deaths, followed by cancer (23.1%). These two diseases have been the top 2 causes of death in Texas and the nation since 1950. The top 5 causes of death for 1994 were the same as for 1993, accounting for almost 70% of all Texas fatalities in 1994. The majority of these deaths were preventable - a cause for regret, but also for renewed public health commitment to preventive care and public safety.

The 10 leading causes of death in 1994

1. Heart disease: 41,544
2. Cancer: 31,378
3. Cerebrovascular disease: 9,247
4. Unintentional injuries: 6,300
5. Chronic lung diseases: 6,250
6. Diabetes mellitus: 4,364
7. Pneumonia and influenza: 3,917
8. HIV: 2,742
9. Suicide: 2,331
10. Homicide: 2,144

Deaths in 1994 due to HIV increased by 7.5% over the 1993 number and by 49.3% over the 1990 number. The most dramatic increase was among blacks and Hispanics, whose numbers increased by 34.7% and 76.3%, respectively, over the 1990 number. Deaths among whites increased 20.8% during the same period.

Deaths due to pneumonia and influenza increased 6.8% in 1994 from the previous year. Those due to chronic liver disease and cirrhosis rose 1.7%, continuing the trend of increases that began five years ago.

Tuberculosis was either the cause of or contributor to 1.6 deaths per 100,000 population, down slightly from the rate of 1.8 deaths per 100,000 population in 1993. In another positive trend, diabetes mellitus deaths were down slightly by 1.4% from 1993.

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While it is encouraging that the number of homicides decreased by 5.5% from 1993, the number of suicides increased by 2.8. That both of these causes of death are entirely preventable highlights the tragedy of these fatalities.

Showing the most positive turn, the number of deaths due to certain conditions originating during the perinatal period has shown a consistent decline from the 1984 rate of 9.1 to a 1994 rate of 4.8 deaths per 100,000 population. Among blacks, the decrease was 15.5%. The infant mortality rate (deaths to infants under 1 year of age) declined 5.3%. The infant mortality rate for blacks decreased 13.7% from the previous year, although it is still approximately twice the rate for white infants and for Hispanic infants.

The leading causes of the 2,290 infant deaths in 1994 were congenital anomalies, sudden infant death syndrome (SIDS), short gestation/low birth weight, respiratory distress syndrome, and unintentional injuries. Short gestation/low birth weight was the leading cause of death among black infants while the leading cause of death in white and Hispanic infants was congenital anomalies.

A total of 2,500 Texas children aged 1 to 19 years died in 1994. The leading cause of death overall in this age group was unintentional injury, followed by homicide, cancer, suicide, congenital anomalies, heart disease, pneumonia and influenza, chronic obstructive pulmonary diseases (COPD), HIV and septicemia. Homicide was the leading cause of death among black children, while unintentional injury headed the list for white and Hispanic children.

For further information contact the TDH Statistical Services Division at (512) 458-7362.