TEACHING IMMUNIZATION for Medical Education

REVISED BY

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SPONSORED BY

Association of Teachers of Preventive Medicine
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PERTUSSIS PREVENTION

Small-Group Booklet

ATPM Association of Teachers of Preventive Medicine

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Department of Family Medicine
University of Pittsburg

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CONTENTS

BACKGROUND ON THE MULTISTATION CLINICAL TEACHING SCENARIOS (MCTS) METHOD

Multistation clinical teaching scenarios (MCTS) were developed to encourage active small-group learning in a clinically relevant context with a modest amount of faculty time. MCTS was developed at Harvard University to teach radiology. Viewboxes were displayed around a room and small groups of students rotated between viewboxes. At each viewbox, a clinical history was given along with questions (e.g., What is the differential diagnosis?).

The MCTS method was modified to address immunization and vaccine-preventable diseases. The curricular goals are to (1) increase learner knowledge about vaccine-preventable diseases, vaccines, indications for vaccinations, and methods to increase vaccine coverage; (2) foster problem-solving abilities; (3) stimulate learning in a clinical context; and (4) help learners gain familiarity with key references, such as the recommendations of the Advisory Committee on Immunization Practices (ACIP).

Three to five persons are assigned to each small group for an MCTS session. All of the small groups simultaneously address the first scenario. Each small group spends approximately 5 to 10 minutes attempting to solve the problem addressed in the scenario. The scenario is then discussed in a large group. The facilitator will call on one of the small groups to present their answers, then the facilitator and large group discuss each small group's response to the scenario and summarize the teaching points. After the first scenario is discussed, each small group works on the second scenario. A large-group discussion follows. The process is repeated for other scenarios, one at a time.

SUGGESTED SCHEDULE FOR MCTS SESSION

1. Arrange chairs in groups of 3 to 5, and separate into small groups.
2. Each small group will receive one copy of the *Small-Group Booklet*.
3. Review the objectives briefly, focusing on the primary objectives.
4. Start the first scenario by having one member of each small group read the scenario aloud. Subsequently, the group should work on answering the questions. Divide the reading materials since each person may not have time to read all of the materials. To answer the questions, small-group members can use previous knowledge and experience, the resource materials, and the abstracts included in selected scenarios.
5. The large group will convene after 5 to 10 minutes, depending on the complexity of the scenario, and one group will be selected to present their answers to the questions. Answers and teaching points will be discussed for 5 to 7 minutes.
6. Repeat steps 4 and 5 for the remaining scenarios.

OBJECTIVES

Primary Objectives

- **At the end of this session, every learner should be able to accomplish the following core set of objectives:**

1. Evaluate a patient with paroxysmal coughing and identify possible diagnoses.
2. Appraise the risk for contracting pertussis after exposure, based upon the number and timing of vaccine doses received.
3. Given a patient scenario, recommend appropriate pertussis vaccination.
4. Discuss with parents general information on vaccine safety and adverse reactions, recognizing fears about vaccine safety.
5. Given an office setting, describe procedures to facilitate vaccine administration.

Secondary Objectives

1. Identify serious disease complications, e.g., pneumonia and encephalopathy, and the age at which they are most likely to occur.
2. Describe the stages of pertussis.
3. Explain that adolescents and adults are the primary reservoir, and treat adolescents and adults with a chronic cough accordingly.
4. Given a patient scenario, recommend vaccination at the minimal allowed interval between doses, if the child is behind in vaccination.
5. Given a patient scenario, screen for valid contraindications and precautions, recognizing the difference between precautions and contraindications.
6. Recognize that (a) use of acellular pertussis vaccines is recommended over whole-cell pertussis vaccines, (b) epidemics have occurred in countries where pertussis vaccination was discontinued, and (c) the Vaccine Injury Compensation Program offers protection to providers.
7. List sources for up-to-date vaccine information.

SCENARIO ONE

Shala is a 3-month-old who showed symptoms of clear rhinorrhea and coughing 2 weeks ago. A diagnosis of bronchiolitis was made when she was seen by her physician 11 days ago. Since then, the cough has developed into paroxysmal bouts that are associated with posttussive emesis. She was breast-feeding well until 2 days before admission, but has not had a wet diaper for 12 hours. At night, the cough keeps her awake and is worse when she is lying down. Her past medical history includes the receipt of the first doses of diphtheria and tetanus toxoids and acellular pertussis vaccine (DTaP), pneumococcal conjugate vaccine, *Haemophilus influenzae* type b (Hib) conjugate vaccine, hepatitis B vaccine, and inactivated poliovirus vaccine (IPV) at 2 months of age. Her mother is a physician and has had a cough for 3 weeks. During the physical exam, Shala had 10 to 20 paroxysmal coughs. These were associated with cyanosis and posttussive emesis. Shala's temperature was 37.9°C (100.2°F); her respiratory rate was 32/min. Her weight was 5.1 kg (down 0.6 kg from 10 days ago). She had a mild subcostal retractions, occasional grunting, and coarse bibasilar rales. Aeration was adequate. No flaring or wheezes were noted. Her white blood cell count was 28,700/mm^3 (elevated).

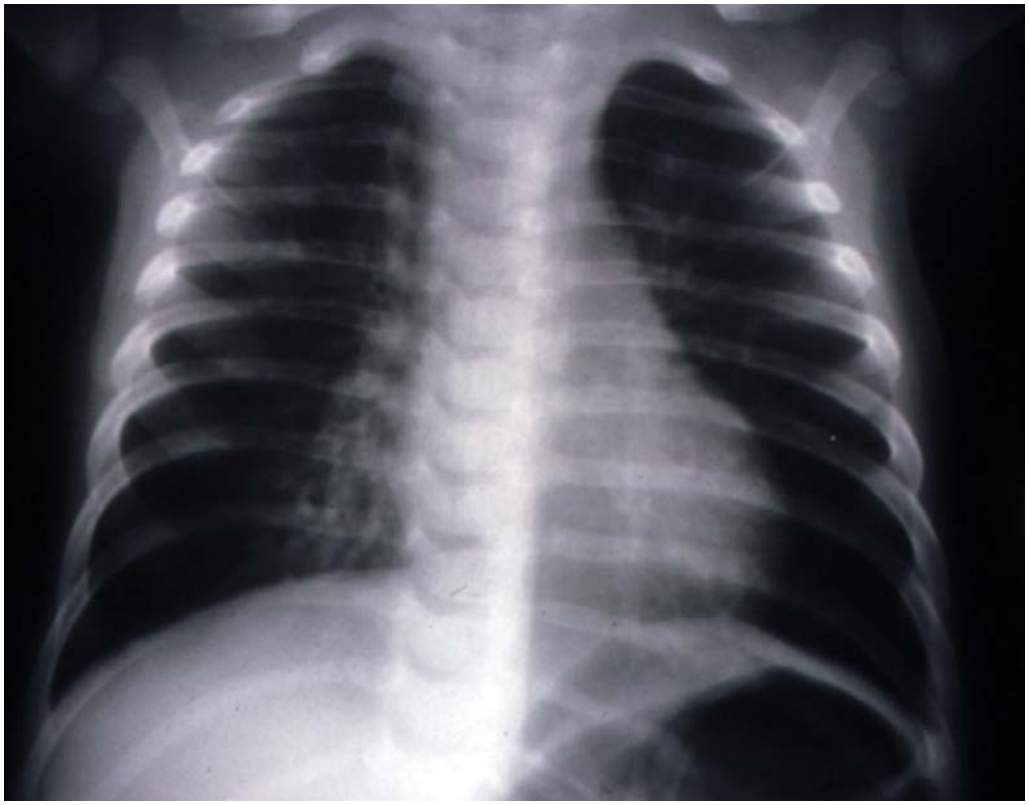
- **Learning Aids**

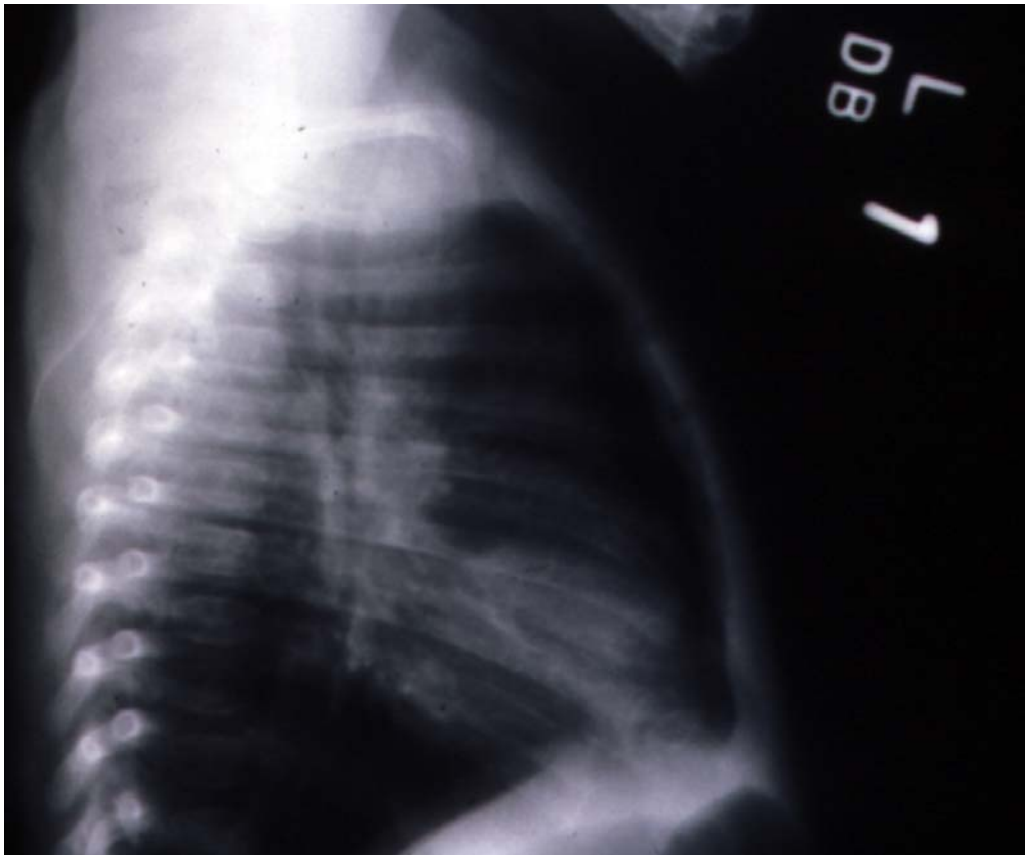
  1. Figure 1: Photos of chest x-ray films
  2. Pertussis. In: Centers for Disease Control and Prevention. *Epidemiology and Prevention of Vaccine-Preventable Diseases*. 8th ed, 2nd printing. Atlanta, GA: Centers for Disease Control and Prevention, National Immunization Program; January 2005: 75-88. http://www.cdc.gov/nip/publications/pink/pert.pdf
  3. Abstract 1

- **Questions for Learners**

  1. What are the possible differential diagnoses for her illness?
  2. What are the serious complications of her current illness?
  3. What should be done for Shala?
  4. From whom did Shala contract pertussis?

Figure 1





Source: University of Pittsburgh School of Medicine

Abstract 1

Epidemiology of pertussis and reactions to pertussis vaccine.
Hodder SL, Mortimer EA, Jr.

The changing epidemiology of pertussis in young infants: The role of adults as reservoirs of infection.

In the United States, adults serve as important sources of infection for young children. Nelson[1] reported that in 12 of 14 reported cases of pertussis occurring in young infants from 1971 to 1977, the source of the infection was an adult. Similarly in a pertussis outbreak in Ohio in 1987, six of the nine cases of pertussis could be epidemiologically linked in a chain of transmission that involved an adult. Recent studies have indicated that subclinical pertussis, primarily in persons with waning immunity, is more frequent than previously believed. Long et al[2] studied 18 household contacts of four infants with pertussis. Five of the 18 contacts had symptomatic pertussis, 10 were concluded to have subclinical infection, and three were without evidence of infection.

[1]Nelson JD. The changing epidemiology of pertussis in young infants: the role of adults as reservoirs of infection. *Am J Dis Child*. 1978;132:371-373.
[2]Long SS, Welkon CJ, Clark JL. Widespread silent transmission of pertussis in families: antibody correlates of infection and symptomatology. *J Infect Dis*. 1990;161:480-486.

Adapted from *Epidemiol Rev*. 1992;14:244

SCENARIO TWO

Rose, a 3-year-old, has a cough illness and a positive culture for pertussis. Questioning her parents revealed the following information:

Name	Age (years)	Relationship to Rose	Number of DTP or DTaP Vacccinations	Symptomatic?*
George	35	Father	5	Yes
Sheree	34	Mother	5	No
Todd	14	Brother	5	Yes
Skip	5	Brother	5	No
Rose	3	Self	2	Yes

DTP = diphtheria and tetanus toxoids and pertussis vaccine; DTaP = diphtheria and tetanus toxoids and acellular pertussis vaccine.
*Rhinorrhea and ≥2 weeks of paroxysmal cough.

George, a resident physician at a local hospital where pertussis has been diagnosed, was the first in the family to have a paroxysmal cough. Review of Rose's records show that she received measles-mumps-rubella vaccine (MMR) and Hib conjugate vaccine at 18 months of age. She had a mild upper respiratory tract infection 2 months ago when she was last seen by her primary care physician.

- **Learning Aids**

1. Recording of Rose's cough. Click here.
2. Pertussis. In: Centers for Disease Control and Prevention. *Epidemiology and Prevention of Vaccine-Preventable Diseases*. 8th ed, 2nd printing. Atlanta, GA: Centers for Disease Control and Prevention, National Immunization Program; January 2005: 75-88. http://www.cdc.gov/nip/publications/pink/pert.pdf
3. *Recommended Childhood and Adolescent Immunization Schedule—United States*. http://www.cdc.gov/nip/recs/child-schedule.htm
4. Abstracts 2, 3, and 4

- **Questions for Learners**

1. What is the clinical case definition of pertussis? Do the persons with the symptoms have pertussis?
2. Why did George and Todd develop pertussis? What should be done for them?
3. Why did Rose develop pertussis? Was Rose's illness preventable?
4. What should be done for Sheree and Skip?
5. Are George's patients at risk? What should be done for George's patients? Should he continue to see patients?

Abstract 2

Case definitions for infectious conditions under public health surveillance.
Centers for Disease Control and Prevention.

Pertussis (Revised 9/96)

Clinical Case Definition: a cough, illness lasting ≥2 weeks with one of the following: paroxysms of coughing , inspiratory "whoop," or posttussive vomiting, without other apparent cause
Probable Case: a case that meets the clinical case definition, is not laboratory confirmed, and is not epidemiologically linked to a laboratory-confirmed case
Confirmed Case: a case that is laboratory-confirmed or one that meets the clinical case definition and is either laboratory confirmed or epidemiologically linked to a laboratory-confirmed case

Abstracted from *MMWR* 1997;46(RR-10):25.

Abstract 3

Spread of pertussis by hospital staff.
Kurt TL, Yeager AS, Guenette S, Dunlop S.

Two separate outbreaks of pertussis occurred within a 3-month period on the pediatric units at the University of Colorado Medical Center. Secondary cases developed among adult members of the hospital staff, as well as among pediatric patients. While most adults were only mildly ill, two adults were seriously incapacitated. Pertussis agglutination titers were performed on sera from 341 adults. Results emphasize the susceptibility of adults to pertussis, and suggest that exposure to pertussis is high among pediatric house officers, medical students, and pediatric nurses as compared to the general population.

Abstracted from *JAMA* 1972;221(3):264-267

Abstract 4

Diphtheria, tetanus, and pertussis: recommendations for vaccine use and other preventive measures: recommendations of the Advisory Committee on Immunization Practices (ACIP).
Centers for Disease Control and Prevention.

Prophylaxis for contacts of pertussis patients.

Erythromycin prophylaxis should be administered for 14 days to all household and other close contacts of persons with pertussis, **regardless of age and vaccination status.** Alternative choices are trimethoprim-sulfamethoxazole for 14 days for patients who cannot tolerate erythromycin or azithromycin for 5 days or clarithromycin for 7 days. Although data from controlled clinical trials are lacking, prophylaxis of all household members and other close contacts may prevent or minimize transmission. All close contacts <7 years of age who have not completed the four-dose primary series should complete the series with the minimal intervals. Those who have completed the primary series but have not received a dose of DTP or DTaP within 3 years of exposure should be given a booster dose. Three acellular pertussis vaccines are available for use among infants: Tripedia®, DAPTACEL®, and Infanrix®. Acellular pertussis vaccine efficacy is estimated at 80% to 85% for vaccines licensed in the United States.

Adapted from *MMWR*. 1991;40(RR-10):1-28, and updated with information from CDC.

SCENARIO THREE

Stephanie, a 2-year-old, is in the office for a well-child exam, the results of which are normal. Her vaccination history reveals that she has received three doses of DTaP, three doses of IPV, four doses of Hib, three doses of hepatitis B vaccine, and four doses of pneumococcal conjugate vaccine. She had chickenpox at age 1 year. Following her third dose of DTaP 6 months ago, she developed a temperature of 38.9°C (102°F) and became fussy. Stephanie's sister has a history of a major motor (grand mal) seizure disorder.

- **Learning Aids**

1. *Recommended Childhood and Adolescent Immunization Schedule*—United States. http://www.cdc.gov/nip/recs/child-schedule.htm
2. *Pertussis Vaccination: Use of Acellular Pertussis Vaccines Among Infants and Young Children—Recommendations of the Advisory Committee on Immunization Practices (ACIP)*; sections: Summary (p.1); Acellular Pertussis Vaccines (p. 3); Table 5: Routine diphtheria, tetanus, and pertussis vaccination schedule for children aged ≤7 years—United States, 1997 (p. 17); Vaccination of infants and young children who have a personal or family history of seizures (pp. 19-20); Adverse Reactions (pp. 20-21); Contraindications (p. 21); Precautions (pp. 21-22); and Vaccine Injury Compensation (p. 22). http://www.cdc.gov/mmwr/preview/mmwrhtml/00048610.htm
3. Abstracts 5 and 6

- **Questions for Learners**

1. Does Stephanie need any vaccinations? What is the minimal interval between DTaP doses?
2. What antigens are in the various acellular pertussis vaccines?
3. Can DTaP cause fever? What can be done to reduce the likelihood of fever after DTaP vaccination?
4. Should Stephanie receive any further doses of DTaP? What is a precaution?
5. What is the Vaccine Injury Compensation Program? Why does the VICP exist?

Abstract 5

Vaccine Injury Compensation Program.

The Vaccine Injury Compensation Program (VICP), established by the National Childhood Vaccine Injury Act of 1986, is a system under which compensation can be paid on behalf of an injured person whose injury was temporally related to vaccination. The program is intended as an alternative to civil litigation under the traditional tort system in that negligence need not be proven. A vaccine injury table was created which lists the vaccines covered and the injuries and conditions for which compensation may be paid. The table also defines the period of time during which the first symptom or substantial aggravation of the injury must appear. The VICP has greatly reduced vaccine-related liability risks for physicians and manufacturers.

Adapted from Centers for Disease Control and Prevention. General Recommendations on Immunization: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR. 1994;43(RR-1):27, and VICP materials.

Abstract 6

Bacteriology of pertussis.
Zimmerman RK, Wald ER.

The etiology of pertussis is *Bordetella pertussis*, an aerobic gram-negative rod. Components (antigens) that are important in the organism's ability to cause disease include (1) a tracheal cytotoxin which destroys cilia, making it difficult to clear the thick mucus; (2) pertussis toxin which causes lymphocytosis, contributes to damage of the cilia, and helps attachment to respiratory epithelium; (3) filamentous hemagglutinin, which helps the bacteria attach to cilia of the respiratory tract; (4) pertactin, which also helps bacterial attachment to the cilia; and (5) fimbriae, which have an uncertain role in pathogenesis. Acellular pertussis vaccines contain purified antigenic components of *Bordetella pertussis*, including inactivated pertussis toxin and may contain one or more other components (e.g. filamentous hemagglutinin, pertactin, and fimbriae types 2 and 3).

SCENARIO FOUR

Dr. Queen is the medical director of a clinic that provides primary care for developmentally delayed children. Many children attending the clinic have trisomy 21 (Down syndrome); hence, they may have concurrent cardiac disorders and seizures. Dr. Queen was concerned about the number of pertussis cases in the community and the threat to children of the clinic, so he reviewed the vaccination records for infants attending his clinic.

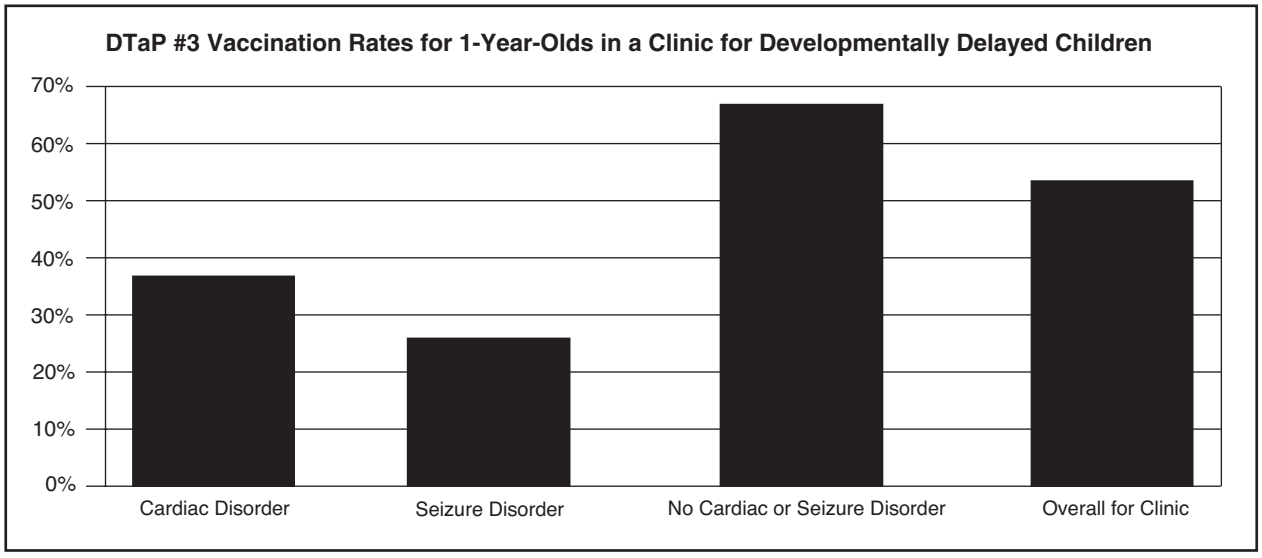
- **Learning Aids**

  1. Figure 2
  2. Abstracts 7 and 8
  3. *Standards for Child and Adolescent Immunization Practices*
     http://www.cdc.gov/nip/recs/rev-immz-stds.htm
  4. *Pertussis Vaccination: Use of Acellular Pertussis Vaccines Among Infants and Young Children—Recommendations of the Advisory Committee on Immunization Practices (ACIP)*; sections: Contraindications (p. 21); and Precautions (pp. 21-22)
     http://www.cdc.gov/mmwr/preview/mmwrhtml/00048610.htm

- **Questions for Learners**

  1. Why are the vaccinations rates low?
  2. What can be done to raise the rates?
  3. What are the valid contraindications to DTaP? Is a cardiac disorder a valid contraindication to DTaP? Is a seizure disorder a valid contraindication for DTaP?
  4. What is a precaution? What are the precautions to DTaP?

Figure 2



Abstract 7

Failure to vaccinate against whooping cough.
Stevens D, Baker R, Hands S.

We describe a prospective study in which we investigated why children fail to get vaccinated against whooping cough. The study included an assessment of the attitudes of parents and professionals and the impact of differing views of the contraindications. There was considerable disagreement among the professionals on the interpretation of the contraindications to immunization; the most common reason for omitting pertussis vaccine was advice from the doctor based on dubious contraindications, such as a family history of epilepsy, a family history of mental retardation, or prematurity.

Adapted from *Arch Dis Child* 1986;61:382-387.

Abstract 8

Evaluation of a follow-up system in county health department's immunization clinic.
Tollestrup K, Hubbard BB.

We designed a pilot follow-up system using two mailed reminders and evaluated it for use in the immunization clinic of a relatively large county health department in the state of Washington. Compliance with the recommended interval for DTP immunization increased by 33.9% in the group of children receiving two postcard reminders compared to the control group. Over half of the respondents (52%) in the control group and 28% in the intervention group reported that transportation barriers and inconvenient clinic hours prevented their return.

Adapted from *Am J Prev Med* 1991;7:24-28

STANDARDS FOR CHILD AND ADOLESCENT IMMUNIZATION PRACTICES

Availability of Vaccines

1. Vaccination services are readily available.
2. Vaccinations are coordinated with other healthcare services and provided in a medical home when possible.
3. Barriers to vaccination are identified and minimized.
4. Patient costs are minimized.

Assessment of Vaccination Status

5. Healthcare professionals review the vaccination and health status of patients at every encounter to determine which vaccines are indicated.
6. Healthcare professionals assess for and follow only medically indicated contraindications.

Effective Communication about Vaccine Benefits and Risks

7. Parents/guardians and patients are educated about the benefits and risks of vaccination in a culturally appropriate manner and in easy-to-understand language.

Proper Storage and Administration of Vaccines and Documentation of Vaccinations

8. Healthcare professionals follow appropriate procedures for vaccine storage and handling.
9. Up-to-date, written vaccination protocols are accessible at all locations where vaccines are administered.
10. Persons who administer vaccines and staff who manage or support vaccine administration are knowledgeable and receive ongoing education.
11. Healthcare professionals simultaneously administer as many indicated vaccine doses as possible.
12. Vaccination records for patients are accurate, complete, and easily accessible.
13. Healthcare professionals report adverse events following vaccination promptly and accurately to the Vaccine Adverse Events Reporting System (VAERS) and are aware of a separate program, the National Vaccine Injury Compensation Program (NVICP).
14. All personnel who have contact with patients are appropriately vaccinated.

Implementation of Strategies to Improve Vaccination Coverage

15. Systems are used to remind parents/guardians, patients, and healthcare professionals when vaccinations are due and to recall those who are overdue.
16. Office- or clinic-based patient record reviews and vaccination coverage assessments are per formed annually.
17. Healthcare professionals practice community-based approaches.

Adapted from The National Vaccine Advisory Committee. *Standards for Child and Adolescent Immunization Practices*. Pediatrics 2003; 112:958-963.

Copies of the Standards may be requested from the NIP website: http://www.cdc.gov/nip/publications/default.htm.