

Teaching Immunization

for Medical Education (TIME)



MULTISTATION CLINICAL TEACHING SCENARIOS

***Haemophilus Influenzae* Type B (Hib) Prevention: Small Group Booklet**

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Haemophilus Influenzae Type B (Hib) Prevention:
Small Group Booklet

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BACKGROUND ON THE MULTISTATION CLINICAL TEACHING SCENARIOS (MCTS) METHOD

The multistation clinical teaching scenarios were developed to encourage active small-group learning in a clinically relevant context with a modest amount of faculty time. The time commitment of both the facilitator and the student is typically 50 to 90 minutes, depending on the setting and goals. The MCTS teaching method may be readily used in medical pre-clinical and clinical years when students' or residents' time is limited. MCTS is well-suited to objective-driven curricula. In the MCTS session, one facilitator can interact with groups ranging from 10 to 30 residents or students. The facilitator needs basic knowledge about the disease and immunization covered but does not need to be a content expert.

Students and residents are assigned to small groups of 2 to 5 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 calls on one of the small groups to present their answers, then the facilitator and the large group discuss each small group's response to the scenario and summarize the teaching points. The facilitator should correct wrong answers and discuss the teaching points. Generally, the large-group discussion should not last more than 7 minutes per scenario. After the first scenario is discussed, each small group works on the second scenario.

A large-group discussion follows. The process is repeated until all scenarios are completed or the allotted time expires.

SUGGESTED SCHEDULE FOR MCTS SESSION

1. Arrange chairs in groups of 3 to 5, and separate students or residents into small groups.
2. Distribute one copy of the Hib Prevention Small-Group Booklet to each group along with a copy of the learning aids listed for the scenarios to be discussed. A major learning aid is needed: appropriate chapter from the CDC's Pink Book, www.cdc.gov/vaccines/pubs/pinkbook/pink-chapters.htm and/or slide set www.cdc.gov/vaccines/pubs/pinkbook/pink-slides.htm, or a shortened version of the same slide set available at http://www.aptrweb.org/resources/curriculum_time.html, SHOTS software from www.immunizationed.org, and/or internet access to CDC's website www.cdc.gov/vaccines. Review the objectives briefly, focusing on the primary objectives.
3. The students or residents are to start the first scenario by having one member of each small group read the scenario aloud. Subsequently, each small group should work on answering the questions for that scenario. To answer the questions, the learners should use their previous knowledge and experience, the resource materials/internet, and the abstracts included in selected scenarios. They should divide the resource materials since each individual may not have time to read all of the materials.
4. Convene as a large group after 5 to 10 minutes, depending upon the complexity of the scenario. Select one group to present their answers to the questions. Critique answers and discuss the teaching points for 5 to 7 minutes.
5. Repeat steps 3 and 4 for the remaining scenarios that have been selected.

Objectives

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

Primary Objectives

1. Identify common clinical presentations and complications of invasive *Haemophilus influenzae* type b (Hib) disease.
2. Summarize the epidemiology of Hib disease, including the mechanism of transmission, population at risk, age distribution, and impact of vaccination.
3. Describe the appropriate schedule, indications, and contraindications for Hib vaccines.

Secondary Objectives

1. Discuss the use of rifampin chemoprophylaxis and Hib vaccines to prevent secondary transmission of Hib disease.
2. Recommend methods to improve Hib vaccination rates.
3. Summarize the adverse reactions reported following Hib vaccinations.

SCENARIO ONE

Vicky is a 9-month-old girl who was seen in her doctor's office last week for a temperature of 102°F (38.9°C) and listlessness. She was diagnosed with otitis media of the left ear, and started on amoxicillin. She is now in the emergency department because 1 hour ago, her mother found her staring blankly, unresponsive to voice or touch. On your exam, Vicky is lethargic. When you attempt to flex her chin to her chest, she cries out and assumes the posture in Figure 1. Vicky received the first dose of DTaP, hepatitis B, Hib, IPV, and PCV at 6 months of age.

Learning Aids

1. Figure 1: Photo showing 9-month-old girl's posture
2. Figure 2: Gram stain of cerebrospinal fluid
3. Abstract 1
4. Centers for Disease Control and Prevention. Haemophilus influenzae type b. In: Epidemiology and Prevention of Vaccine-Preventable Diseases. Atkinson W, Wolfe S, Hamborsky J, McIntyre L, eds. 11th ed. Washington DC: Public Health Foundation, 2009. Slide set: <http://www.cdc.gov/vaccines/pubs/pinkbook/downloads/Slides/Hib11.ppt> or the shortened form from http://www.aptrweb.org/resources/curriculum_time.html
5. Centers for Disease Control and Prevention. Current Recommended Immunization Schedules for Persons Aged 0 through 6 Years and 7 Through 18 Years -- United States. <http://www.cdc.gov/vaccines/recs/schedules/default.htm>

Questions for Learners

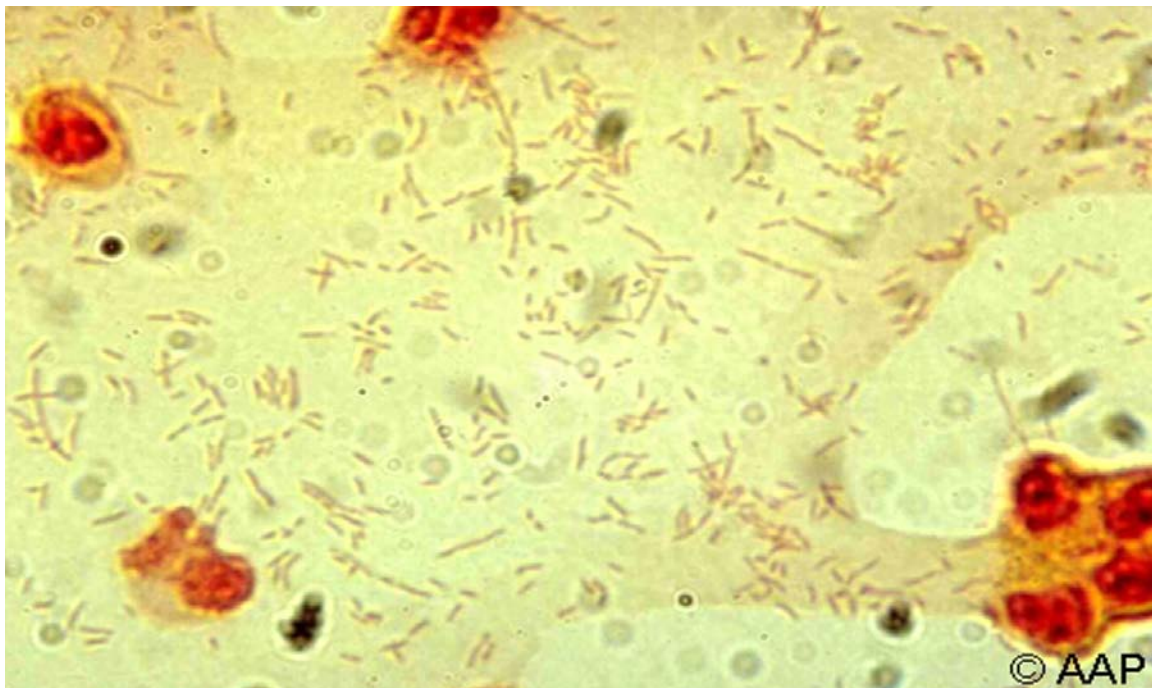
1. What is Vicky's diagnosis? What are the most common organisms causing this disease?
2. Based on the Gram stain of Vicky's cerebrospinal fluid (Fig. 2), what organism is likely to be causing her illness?
3. What other illnesses are caused by this organism?
4. Discuss the morbidity and mortality associated with Vicky's illness.
5. Was this disease preventable?

Figure 1 Photo showing 9-month-old girl's posture



Source: Zitelli BJ, Davis HW, eds. *Atlas of Pediatric Physical Diagnosis*. 2nd ed. New York, NY: Gower Medical Publishing; 1992; Fig. 12.20A. Reproduced with permission.

Figure 2 *Haemophilus influenzae* Infections Gram stain of cerebrospinal fluid (culture positive for *H influenzae* type b).



Source: Red Book On-line Visual Library, 2009. Used with Permission

Abstract 1***Haemophilus influenzae type b. Burns IT***

Before the introduction of effective vaccines in 1987, *Haemophilus influenzae* type b (Hib), a gram negative coccobacillus, was the leading cause of bacterial meningitis and other invasive bacterial disease among children <5 years of age. At that time, almost all serious Hib infections were seen in children <5 years of age and approximately 1 in 200 children developed invasive Hib disease before the age of 5 years.

H. influenzae occurs in six encapsulated types and in unencapsulated forms. In the pre-vaccine era, type b (Hib) caused 95% of invasive *Haemophilus influenzae* diseases, such as meningitis, epiglottitis, pneumonia, cellulitis, arthritis, osteomyelitis, and pericarditis.

The most common form of invasive Hib disease is meningitis. Symptoms of meningitis may include fever, mental status change, vomiting, and headache. Infants may have bulging fontanelles. Inflammation of the meninges leads to neck stiffness. Maneuvers that put traction on the inflamed meninges cause pain.

Hib meningitis cannot be distinguished clinically from other types of meningitis. Other bacterial causes of meningitis include *Neisseria meningitidis* and *Streptococcus pneumoniae*. Less common causes include Group B streptococcus, *Listeria monocytogenes* (especially in newborns), *Mycobacterium tuberculosis*, enteric bacteria, fungi, and viral agents.

Rapid diagnosis and treatment are essential in Hib meningitis. Even with appropriate antibiotic therapy (usually a third-generation cephalosporin such as cefotaxime or ceftriaxone is recommended), the mortality rate is 2% to 5%. Neurologic sequelae such as hearing or vision loss and hydrocephalus occur in 15% to 30% of survivors of Hib meningitis.

SCENARIO TWO

Vicky is a 9-month-old girl hospitalized with Hib meningitis. Vicky has a 22-month-old sister, Vanessa, and a 6-year-old brother, Alex. Vicky's mother provides 50 hours a week of child care in her home for Mary, an unvaccinated 4-month-old girl.

Learning Aids

1. Summary of Hib vaccination records for Vicky and her household contacts.
2. Centers for Disease Control and Prevention. Current Recommended Immunization Schedules for Persons Aged 0 Through 6 Years and Catch-Up -- United States.

<http://www.cdc.gov/vaccines/recs/schedules/default.htm#child>

3. Abstract 2

Questions for Learners

1. Do Vicky, Vanessa, Alex, or Mary require Hib vaccination? Recommend appropriate vaccines and schedules.
2. Who among Vicky's family and household contacts should receive rifampin chemoprophylaxis?

Summary of Vaccination Records

Child	Age	Number of Hib Doses	Age at Administration (months)
Vicky	9 months	1	6
Vanessa	22 months	3	3,6,9
Alex	6 years	4	2,4,6,18
Mary	4 months	0	NA

Abstract 2

For household contacts of a person with invasive Hib disease, no rifampin chemoprophylaxis is indicated if all persons are 48 months of age or older, or if children younger than 48 months of age are fully vaccinated. In households with one or more infants younger than 12 months of age, with a child 1-3 years of age who is inadequately vaccinated, or with an immunocompromised child, all household contacts, including the index case-patient, should receive rifampin prophylaxis. The recommended dose is 20 mg/kg as a single daily dose (maximal daily dose 600 mg) for 4 days. Neonates (less than 1 month of age) should receive 10 mg/kg once daily for 4 days. The risk of Hib invasive disease for child care center contacts of a patient with Hib invasive disease case is thought to be lower than that for a susceptible household contact.

Modified from: Centers for Disease Control and Prevention. Chapter 2: Haemophilus influenzae Type b Invasive Disease. Manual for the surveillance of vaccine-preventable diseases. 4th edition. Centers for Disease Control and Prevention, Atlanta, GA, 2008.

<http://www.cdc.gov/vaccines/pubs/surv-manual/chpt02-hib.htm>

SCENARIO THREE

Vicky, a 9-month-old girl, is seriously ill with Hib meningitis. A story about her appeared on the evening news. Your office is now being inundated with phone calls from concerned parents who have questions about Hib disease and vaccinations.

Learning Aid

1. Centers for Disease Control and Prevention. Haemophilus influenzae type b. In: Epidemiology and Prevention of Vaccine-Preventable Diseases. Atkinson W, Wolfe S, Hamborsky J, McIntyre L, eds. 11th ed. Washington DC: Public Health Foundation, 2009: Centers for Disease Control and Prevention. The Pink Book. Slide set:
<http://www.cdc.gov/vaccines/pubs/pinkbook/downloads/Slides/Hib11.ppt>
2. Centers for Disease Control and Prevention. Current Recommended Immunization Schedules for Persons Aged 0 Through 6 Years and Catch-Up -- United States.
<http://www.cdc.gov/vaccines/recs/schedules/default.htm#child>

Questions for Learners

1. One parent asks: "My child is scheduled for a Hib vaccination tomorrow, but she is still on antibiotics for an ear infection diagnosed last week. Should I reschedule her appointment?" Explain contraindications to Hib vaccination.
2. The father of a 3-month-old calls with questions about Hib vaccine. The baby has had no vaccinations because the parents have heard that vaccinations have dangerous side effects. What can you tell the father about the adverse reactions associated with Hib vaccine?
3. A reporter from the local paper calls for information for a story she is writing. She asks you:
 - a. How is Hib spread?
 - b. Who should receive Hib vaccination?

SCENARIO FOUR

Joshua is a previously healthy 4-year-old boy. He has not received any Hib vaccine, as his parents have a philosophical objection to vaccinations.

His parents have brought him to the emergency department at 3 AM, because he is having trouble swallowing. He was fine when he went to bed, but he woke up at midnight complaining of a very sore throat.

His temperature is 103°F (39.4°C), his heart rate is 156 beats per minute, and his respiratory rate is 36 breaths per minute. As you enter the examination room, you can hear stridor with each breath he takes. He is sitting upright, leaning forward, and drooling.

Learning Aids

1. Abstract 3
2. Figure 3: Photo of Joshua
3. Centers for Disease Control and Prevention. Haemophilus influenzae type b. In: Epidemiology and Prevention of Vaccine-Preventable Diseases. Atkinson W, Wolfe S, Hamborsky J, McIntyre L, eds. 11th ed. Washington DC: Public Health Foundation, 2009: Centers for Disease Control and Prevention. The Pink Book. Slide set:
<http://www.cdc.gov/vaccines/pubs/pinkbook/downloads/Slides/Hib11.ppt>

Questions for Learners

1. What are possible diagnoses for Joshua's illness? What microorganisms might be responsible?
2. What steps should you take immediately to evaluate and treat Joshua?
3. How has the widespread use of Hib vaccine affected the incidence of invasive Hib disease?

Abstract 3**Epiglottitis. Burns IT.**

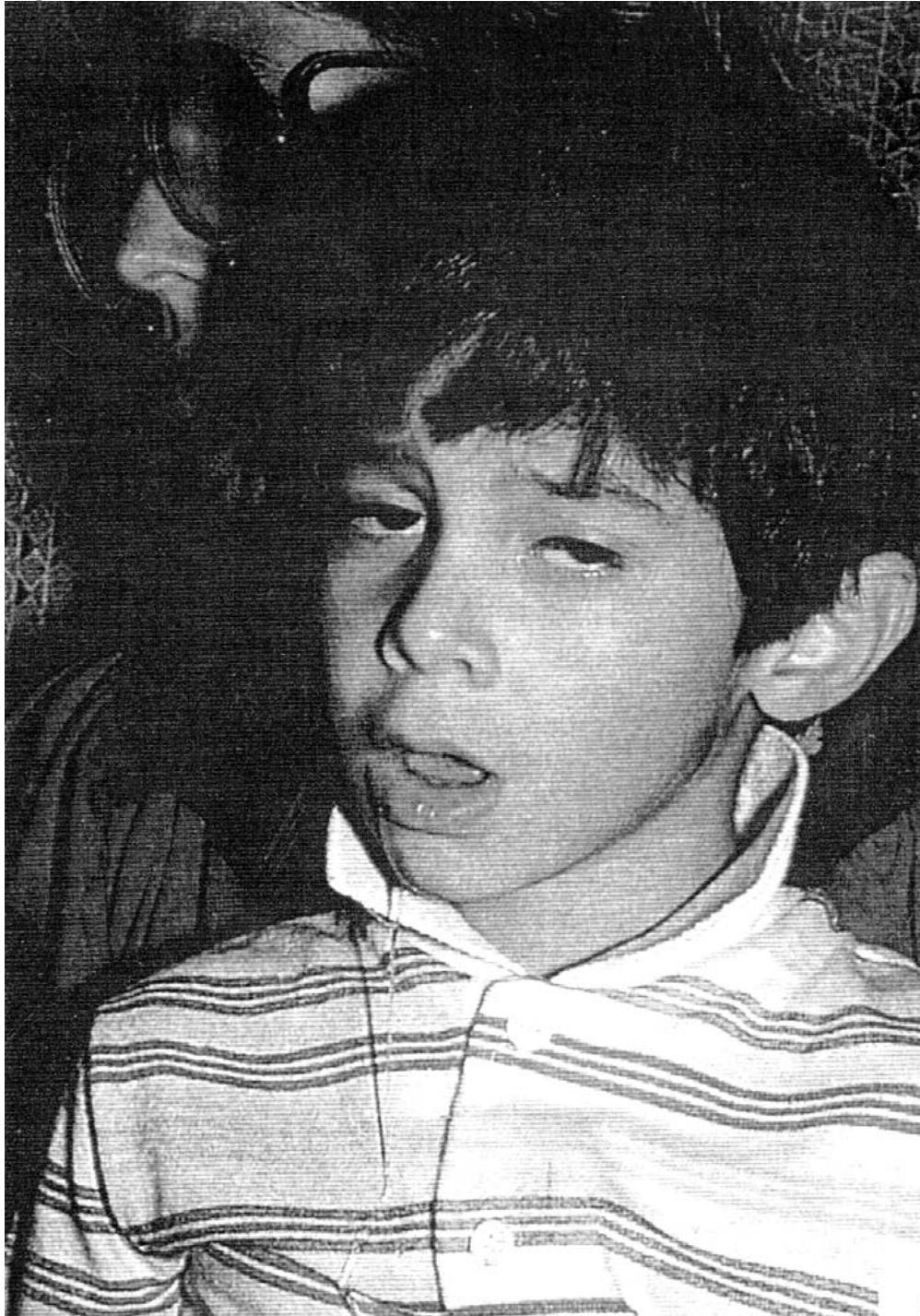
Epiglottitis is an acute airway infection. In unvaccinated populations, its most common cause is *Haemophilus influenzae* type b. Other causes include Group A beta-hemolytic streptococcus, *Staphylococcus aureus*, *Streptococcus pneumoniae*, or *Candida albicans*. The differential diagnosis for a child suspected of having epiglottitis also includes parapharyngeal abscess or cellulitis, laryngotracheobronchitis (croup), foreign body, angioedema, expanding congenital anomaly, thermal injury, or caustic ingestion.

Most commonly, the child with epiglottitis has a history of acute onset of a sore throat and fever. Over the course of hours, the child may progress to difficulty with speech and swallowing, as well as pain and difficulty with breathing. Children with epiglottitis may assume a “tripod” or “sniffing” posture, in which they sit upright, leaning forward, with mouth open and jaw thrust forward. This position maximizes the diameter of the upper airway. Stridor can be heard.

The best means of diagnosing suspected epiglottitis is controversial. A lateral neck x-ray film showing the “thumb sign” of a thickened epiglottitis can be helpful, but a severely ill child should not have definitive airway management delayed while waiting for x-rays. In a severely ill child, direct laryngoscopic visualization and emergent intubation, preferably by a specialist, is required to protect the airway. If equipment and personnel to perform this are not available, the spontaneously breathing child should be kept as calm as possible, and given supplemental oxygen. If both bag and mask ventilation and intubation are impossible due to airway obstruction, cricothyroidotomy should be performed.

Once the airway has been secured, cultures of the surface of the epiglottis and blood should be obtained. Antibiotic therapy with a third generation cephalosporin, such as cefotaxime or ceftriaxone should be begun immediately after cultures are obtained.

Figure 3



Source: Zitelli BJ, Davis HW, eds. Atlas of Pediatric Physical Diagnosis. 2nd ed. New York, NY: Gower Medical Publishing; 1992; Fig. 22.78B. Reproduced by permission.

SCENARIO FIVE

You have recently taken over the practice of a retiring physician. You have discovered that because Dr. Johnson did not see many children, the office has not stocked all available types of vaccine in the past. Also, from 2008 to 2010, there were production problems with some brands of Hib-containing vaccines (PedvaxHIB[®] and Comvax[®]), leading to vaccine shortages. Mrs. Walker has brought in her four children for well-child visits. None of the children have any chronic medical problems.

Your current vaccine stocks include: PRP-T (both ActHIB[®] and Hiberix[®]), PRP-OMP (PedvaxHIB[®]), and the combination vaccines DTaP-IPV/Hib (Pentacel[®]) and Hib-Hepatitis B (Comvax[®]).

Learning Aids

1. The children's vaccination records.
2. Table of *Haemophilus influenzae* type b Containing Vaccines.
3. Abstract 4.
4. Centers for Disease Control and Prevention. Haemophilus influenzae type b. In: Epidemiology and Prevention of Vaccine-Preventable Diseases. Atkinson W, Wolfe S, Hamborsky J, McIntyre L, eds. 11th ed. Washington DC: Public Health Foundation, 2009.: Centers for Disease Control and Prevention. The Pink Book. Slide set:
<http://www.cdc.gov/vaccines/pubs/pinkbook/downloads/Slides/Hib11.ppt>
5. Centers for Disease Control and Prevention. Current Recommended Immunization Schedules for Persons Aged 0 Through 6 Years and Catch-Up -- United States.
<http://www.cdc.gov/vaccines/recs/schedules/default.htm#child>

Questions for Learners

1. How many doses of Hib vaccine will each child need to complete the series?
2. Which vaccine would you use for each child?
3. Is there a problem with using different Hib vaccine types to complete the series?

4. You are concerned that these children have not been vaccinated in a more timely fashion. You perform a chart audit of the children in your new practice, and discover that only sixty percent have received adequate Hib vaccination. Can you suggest ways to improve the vaccination rate?

Summary of Vaccination Records

Name	Current Age	Number and Type of Hib
Jenny	4 months	1 PRP-T (ActHIB [®]) at 2 months
Joey	10 months	1 PRP-OMP (PedvaxHIB [®]) at 5 months
Mary Beth	4 years	None
Maggie	6 years	None

Table

Haemophilus influenzae type b Containing Vaccines

Name	Hib Conjugate Antigen	Combination Vaccine?	Schedule
ActHIB	PRP-T	No	2, 4, 6, and 12-15 months
Hiberix	PRP-T	No	Booster dose \geq 12 months
Pentacel	PRP-T	Yes, with DTaP-IPV	2, 4, 6, and 12-15 months
PedvaxHIB	PRP-OMP	No	2, 4, and 12-15 months
Comvax	PRP-OMP	Yes, with hepatitis B vaccine	2, 4, and 12-15 months

Abstract 4**Improving pediatric vaccination rates**

Children who require vaccination should not have to undergo routine physical examinations or long scheduling waits if this would interfere with the timely receipt of vaccines. Children should be screened for completeness of vaccination at every encounter, and not just at designated well-child visits. Office staff other than physicians should be trained to assess vaccination status at each office visit, and take appropriate action.

All vaccines for which the child is eligible should be given simultaneously. Combination vaccines are available, which can help to minimize the number of injections required to fully vaccinate a child.

Providers should educate themselves about true contraindications to the use of each vaccine, and screen each child and family for these contraindications before administering the vaccination. By recognizing false contraindications to vaccination, providers will miss fewer opportunities to vaccinate children.

Providers should educate families about the reasons for vaccination, and provide information about the benefits and risks of vaccinations they recommend. Written materials that cover this information in easy to understand language is available for all of the recommended vaccines. Families should be encouraged to keep their own personal copy of children's vaccination records. At each visit, families should be educated about when the next vaccinations are required.

Because providers do not always realize that children in their care may be behind on vaccinations, it is important that they assess the vaccination rates in their practices. Chart audits provide important information about how well a practice is succeeding in ensuring timely vaccinations. Tracking systems, which remind providers when children are due to return for vaccinations, can be helpful. Reminders to parents in the form of telephone calls or letters can help them to remember to bring children for vaccinations.

Adapted from the National Vaccine Advisory Committee. *Standards for child and adolescent immunization practices*. *Pediatrics* 2003; 112:958-63.