# TEACHING IMMUNIZATION for Medical Education

REVISED BY

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SPONSORED BY

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# MEASLES PREVENTION

## *Small-Group Booklet*

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# TEACHING IMMUNIZATION for Medical Education


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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 immunizations 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 students or residents into small groups.
2. Distribute copies of the objectives from the *Measles Small-Group Booklet* along with a copy of the learning aids listed for the scenarios to be discussed to each small-group member
3. Review the objectives briefly, focusing on the primary objectives.
4. Instruct the residents or students 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. Instruct them to divide the resource materials since each individual may not have time to read all of the materials. Also instruct them to stay on the same page so everyone is working on the same scenario. To answer the questions, the learners should use their previous knowledge and experience, the resource materials (suggested parts are listed), and the abstracts included in selected scenarios.
5. Convene as a large group after 5 to 10 minutes, depending on the complexity of the scenario. Select one group to present their answers to the questions. Critique their answers and discuss the teaching points for 5 to 7 minutes.
6. Repeat steps 4 and 5 for the remaining scenarios that you have selected.

## 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 a rash and identify probable diagnoses.
2. Discuss the high degree of infectivity of measles.
3. Explain the general epidemiology of recent measles outbreaks, including: transmission in areas with low rates of vaccination, such as urban lower socioeconomic areas, transmission in medical and school settings, and vaccine failure.
4. Given a patient scenario, recommend measles, mumps, and rubella (MMR) vaccination appropriately, according to guidelines on age, occupation, and entry into post-high school educational institutions.
5. Given an office setting, describe office procedures to facilitate vaccine administration.

### Secondary Objectives

1. Identify serious complications of measles, e.g., pneumonia and encephalitis.
2. Appraise the risk for the patients' contacts, based on airborne and direct transmission.
3. Recognize that the level of passively acquired maternal antibodies to measles in infants depends on whether the maternal antibodies developed in response to measles disease or vaccination.
4. Recommend MMR administration subcutaneously.
5. Given a patient scenario, screen patients for valid contraindications to MMR vaccination, e.g., pregnancy.
6. Discuss patient information on MMR safety.
7. Given a patient with a mild illness, recommend MMR, if indicated.
8. Given a patient who is receiving another vaccine, recommend simultaneous vaccination with MMR, if indicated.

## SCENARIO ONE

Jim, a 17-month-old child, was seen 3 days ago for cough, fever, conjunctivitis, and decreased appetite. On physical examination, bulging, erythematous tympanic membranes were noted. Jim was diagnosed with bilateral acute otitis media and treated with amoxicillin. Yesterday, a rash began on his face and trunk (see photographs). Physical exam reveals a temperature of 38.6°C (101.5°F) rectally and blue-white spots on the buccal mucosa.

- **Learning Aids**

  1. Photos on pages 9 - 11
  2. Differential Diagnosis of Typical Measles, (page 8)

- **Questions for Learners**

  1. What are the possible differential diagnoses for Jim's illness?
  2. What are the blue-white spots on the buccal mucosa?
  3. How can Jim's disease be differentiated from the other classic exanthems of childhood? List the differences.

## Differential Diagnosis of Typical Measles

| Disease | Agent | Typical Season | Typical Age | Prodrome | Fever | Duration of Rash (days) | Rash | Other Signs & Symptoms |
|---|---|---|---|---|---|---|---|---|
| Measles | Paramyxovirus Measles virus | Winter, Spring | 1 to 20 years | 2-4 days of cough, conjuctivitis, and coryza | High | 5 - 6 | Erythematous, irregular size, maculopapular; starts on temples & behind ears; progresses down from face; fades to brownish | Koplik's spots C blue-white papules (salt grains) on bright red mucosa opposite premolar teeth |
| Mucocutaneous lymph node syndrome (Kawasaki disease) | Unknown | Winter, Spring | < 5 years | 3 days of abrupt fever | High; fever of 5 days is key sign | 5 - 7; varies | Erythematous, morbilliform, maculopapular or scarlatiniform, central distribution; erythematous, indurated palms and soles | Acute: dry, fissured & injected lips, strawberry tongue; irritability; cervical lymphadenopathy; conjunctival injection; peripheral edema Subacute: finger-tip desquamation; Complications: arthritis, carditis |
| Roseola Infantum (exanthem subitum) | Human herpes virus type 6 | Any | 6 mos. to 2 years | None | High | 1-2; it follows deferves-cence | Discrete erythematous macules, rarely involves face, begins as fever ends | Lymphadenopathy, irritability |
| Rubella | Togavuris | Spring, (late winter) | 7 mos. to 29 years | 0 - 4 days; mild malaise, fever; absent in children | Low-grade | 1 - 3 | Discrete, rose-pink, diffuse, maculopapular; progresses downward from face, may change quickly | Arthralgia (usually in adults), tender posterior cervical & suboccipital lymphadenopathy, malaise, petechiae on soft palate |
| Scalet Fever | ß-hemolytic streptococci | Winter | > 2 years | 0 - 1 day, marked | Low-High | 2 - 7 | Scarlet "sunburn" with punctate papules "sand-paper", circumoral pallor, increased intensity in skin folds, blanches, starts face/head/ upper trunk and progresses downward | Sore throat, exudative tonsillitis, vomiting, abdominal pain, lmphadenopathy, white then red strawberry tongue |
| Erythema Infectiosum (Fifth Disease) | Human parvovirus type B19 | Spring | 5 - 10 years | None usually in children, may occur in adults | None to Low-grade | 2 - 4 | Starts as "slapped cheek", maculopapular; progresses to reticular (lacy) pattern; can recur with environmental changes such as sunlight exposure | Arthralgia/arthritis in adults, adenopathy |
| Enterovirus | Echovirus Coxsackie virus | Summer (Fall) | Mainly childhood | 0 - 1 day fever and myalgias | Low-High | 1 - 5 | Fine, pink, always affects face; variant is Boston exanthem (large ~ 1 cm, discrete maculopapules) | Sore throat, headache, malaies, no lymphadenopathy, gastroenteritis |
| Dengue Fever | Dengue virus types 1 - 4 (Flavivirus) | | | None | High | 1 - 5 | Generalized maculopapular rash after defervescence; spares palms and soles | Headache, myalgia, abdominal pain, pharyngitis, vomiting |
| Drug Rash | Penicillins, sulfonamide etc. | Any | Any | Possible due to underlying illness | Possible | Varies | Typically diffuse but may be concentrated in diaper area, typically no progression, erythema multiform rash can progress over a few days | Possibly due to underlying illness or complications |
| Infectious Mononucleosis | Epstein-Barr Virus | None | 10 - 30 years | 2-5 days of malaise and fatigue | Low-High | 2 - 7 | Trunk and proximal extremities. Rash com-mon if Ampicillin given | Pharyngitis, lymphadenopathy, splenomegaly, malaise |
| Pharyno-conjunctival Fever | Adenovirus types 2, 3, 4, 7, 7a | Winter, Spring | < 5 years | | Low-High | 3 - 5 | Starts on face and spreads down to trunk and extremities | Sore throat, conjunctivitis, headache, anorexia |

Adapted from Centers for Disease Control and Prevention. Epidemiology, Prevention, and Control of Vaccine-Preventable Diseases. Atlanta, GA: Centers for Disease Control and Prevention; 1992; Chap 9.

Dengue Petechiae and tourniquet test pictures
*-Photo Courtesy of Centers for Disease Control & Prevention*

Dengue Fever
*-Photo Courtesy of Centers for Disease Control & Prevention*


Rash from taking Amoxicillin During Infectious Mononucleosis–Epstein Barr Virus Infection


Enterovirus Rash


Enterovirus Rash: Hand, Footh & Mouth Disease


Mucocutaneous Lymph Node Syndrome (Kawasaki Disease)

*All photos used with permission of American Academy of Pediatrics unless otherwise noted.*


Mucocutaneous Lymph Node Syndrome (Kawasaki Disease)


Parvovirus Rash


Parvovirus Rash


Rocky Mountain Spotted Fever


Rocky Mountain Spotted Fever


Roseola Rash

*All photos used with permission of American Academy of Pediatrics unless otherwise noted.*


Roseola Rash

Roseola
*-reprinted with the permission of Cambridge University Press*


Scarlet Fever

Rubella
*-Photo Courtesy of Centers for Disease Control & Prevention*

Blueberry Muffin Rash from Congenital Rubella Syndrome
*-Photo Courtesy of Centers for Disease Control & Prevention*

*All photos used with permission of American Academy of Pediatrics unless otherwise noted.*

## SCENARIO TWO

Sheree, an 18-month-old child, was seen by her primary care physician for an upper respiratory tract infection (URI) 2 weeks ago. She was afebrile but had rhinorrhea. She was sent home with symptomatic treatment for her URI, which resolved. Another child, Mike, was in the office at the same time as Sheree — but never in the same room. Mike was seen for a rash which was diagnosed as measles. Sheree began coughing 4 days ago and her rhinorrhea recurred. Today, a maculopapular rash started on her face.

- **Learning Aids**

1. Summary of Sheree's vaccination record (below)
2. Abstracts and figure, on the following page
3. Measles, mumps, and rubella — vaccine use and strategies for elimination of measles, rubella, and congenital rubella syndrome and control of mumps: recommendations of the Advisory Committee on Immunization Practices (ACIP); sections: Simultaneous Administration of Vaccines, Precautions and Contraindications: Severe Illness. MMWR 1998; 47(RR-8). http://www.cdc.gov/mmwr/PDF/RR/RR4708.pdf
4. Centers for Disease Control and Prevention. Recommended childhood and adolescent immunization schedule —United States. (use lastest version) http://www.cdc.gov/nip/recs/child-schedule.htm

- **Questions for Learners**

1. Was Sheree's case preventable? How?
2. Did Sheree contract measles from the child in the medical office?
3. What steps can a physician take to prevent the transmission of measles in the office setting?

**Name: Sheree Jones**

| Vaccine | Number of Doses | Age at Administration | Route |
|---|---|---|---|
| DTaP | 4 | 2, 6, 9, 17 months | IM |
| IPV | 3 | 2, 6, 17 months | SQ |
| Hib and PCV | 4 | 2, 6, 9, 17 months | IM |
| Hepatitis B | 3 | birth, 1, 9 months | IM |
| MMR | 0 | | |
| Varicella | 0 | | |
| Influenza | 2 | 6, 7 months | IM |

**Measles Outbreak Among Unvaccinated Preschool-Aged Children: Opportunities Missed by Health Care Providers to Administer Measles Vaccine.**

**Hutchins SS, Escolan J, Markowitz LE, Hawkins C, Kimbler A, Morgan RA, Preblud SR, Orenstein WA.**

A measles outbreak in an inner-city area primarily involved preschool-aged children younger than 5 years of age. The authors investigated 31 unvaccinated preschool children with measles disease who had not been vaccinated. Health care providers missed opportunities to vaccinate some eligible patients against measles. Ten of the 26 (38%) patients whose full immunization status was known were vaccinated with diphtheria and tetanus toxoids and pertussis vaccine and/or oral poliovirus vaccine at a time when they could have received measles vaccine simultaneously (according to recommendations of the ACIP and the AAP). In addition, 5 of 10 health care providers missed at least one opportunity to administer measles vaccine because of a minor illness that was not a contraindication to vaccination. Unvaccinated patients were more likely to receive health care in the public sector, have single mothers, and have parents who had no knowledge of existing vaccines; they were less likely to be age-appropriately immunized with other antigens.

Abstracted from *Pediatrics* 1989;83:369-374.

**Measles Outbreak in a Pediatric Practice: Airborne Transmission in an Office Setting.**

**Bloch AB, Orenstein WA, Ewing WM, Spain WH, Mallison GF, Herrmann KL, Hinman AR.**
(See office layout page 18)

In February 1981, a measles outbreak occurred in a pediatric practice. The source patient, a 12-year-old boy vaccinated against measles at 11 months of age, was in the office for one hour on the second day of his rash, primarily in a single examining room. He was coughing vigorously when examined. Seven secondary cases of measles occurred due to exposure in the office. Four children had transient contact with the source patient as he entered or exited through the waiting room; only one of the four had face-to-face contact within 1 m of the source patient. The three other children who contracted measles were never in the same room with the source patient; one of the three arrived at the office one hour after the source patient had left. The risk of measles for unvaccinated infants (attack rate 80%, 4/5) was 10.8 times the risk for vaccinated children (attack rate 7%, 2/27) ($p = .022$). Airflow studies demonstrated that droplet nuclei generated in the examining room used by the source patient were dispersed throughout the entire office suite. The outbreak supports the fact that measles virus can survive at least one hour when it becomes airborne. The rarity of reports of similar outbreaks suggests that airborne spread is unusual.

Abstracted from *Pediatrics* 1985;75:676-683.

## SCENARIO THREE

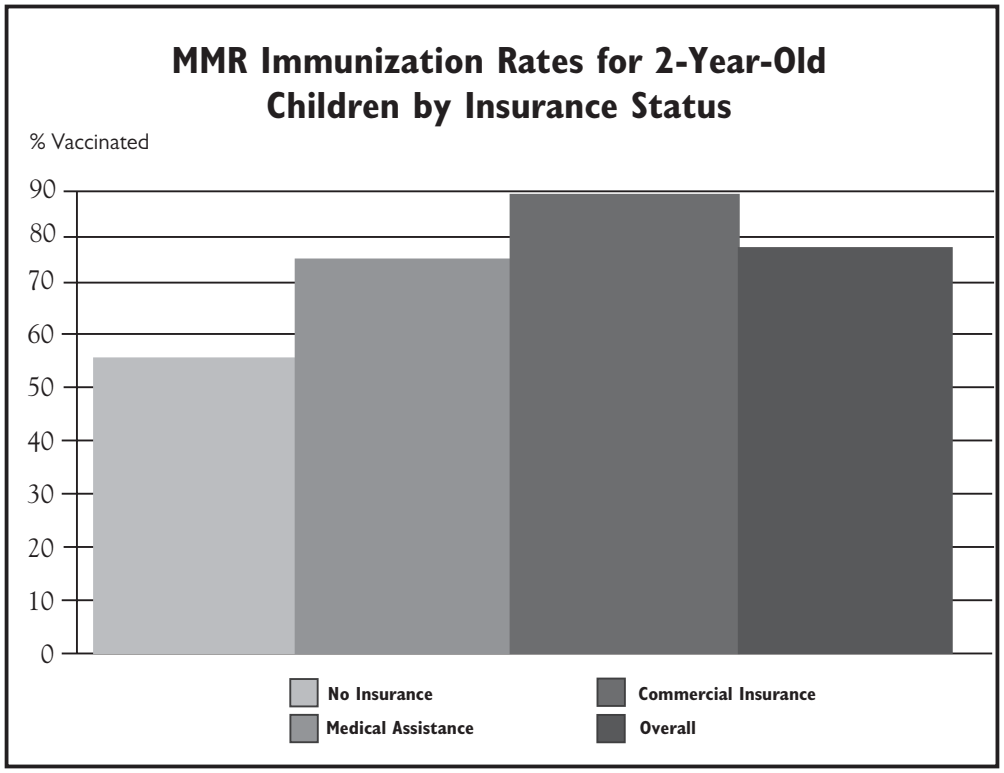
Dr. Jones is disturbed that eight of the children in O'Hara Street Medical Center, an inner-city clinic that is staffed by three physicians, have developed measles and that three have had significant complications (dehydration or pneumonia). Audits of the clinic's records indicate that none of the eight had received measles, mumps, and rubella vaccine (MMR), although six were old enough. Dr. Jones had the office manager program the office billing computer to generate a graph of MMR vaccination dates by insurance coverage. The clinic accepts Medical Assistance, which covers the cost of MMR vaccine.

- **Learning Aids**

1. Graph of MMR Vaccination Rates for 2-Year-Old Children by Insurance Status (below)
2. Standards for Pediatric Immunization Practices, on following page

- **Questions for Learners**

1. What are possible explanations for the low vaccination rates? List reasons. Why is there a difference in vaccination rates based on insurance status if Medical Assistance covers vaccinations?
2. How can Dr. Jones and the clinic staff encourage parents to bring their children to the clinic for vaccinations?
3. Once a child has arrived at the clinic, what can Dr. Jones and the clinic staff do to improve vaccination rates, i.e., decrease missed opportunities?



## STANDARDS FOR CHILDHOOD 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: www.cdc.gov/nip/publications/default.htm.

## SCENARIO FOUR

Two days ago, Tom, an 18-month-old child, developed cough, coryza, conjunctivitis and a temperature of 39.7°C (103.4°F) rectally. He developed a maculopapular rash today. Tom's playmate was diagnosed recently with measles. Tom's father, who was born in 1964, received live measles vaccine at 9 months of age. His mother is a college student who received one dose of measles vaccine at 15 months of age. Clinical records indicate that Tom has received three doses of poliomyelitis vaccine, four doses of diphtheria and tetanus toxoids and acellular pertussis vaccine (DTaP), four doses of *Haemophilus influenzae* type b (Hib) vaccine, two doses of influenza vaccine, and four doses of pneumoccocal conjugate vaccine. Tom has two well siblings: Bill, a 13-year-old who was given MMR at 12 months of age and Margaret, a 6-month- old. Tom's father is a respiratory therapist at a local hospital.

- **Learning Aid**

1. Measles, mumps, and rubella — vaccine use and strategies for elimination of measles, rubella, and congenital rubella syndrome elimination and mumps control: recommendations of the Advisory Committee on Immunization Practices (ACIP); sections: Dosage and Route of Administration, Routine vaccination: School-aged Children and Adolescents; Routine Vaccination: Among Colleges and Other Post-High School Institutions, Use of Vaccine and Immune Globulin Persons Exposed to Measles, Rubella, or Mumps; Measles Case Investigation and Outbreak Control: Measles Outbreaks in Medical Settings; and Table 1 — Acceptable evidence of immunity to measles, rubella, and mumps. MMWR 1998; 47(RR-8): 1-57. http://www.cdc.gov/mmwr/PDF/RR/RR4708.pdf

- **Questions for Learners**

1. Is Bill up-to-date on measles vaccination? What should be done for Bill?
2. What should be done for Margaret?
3. Are the parents up-to-date on measles vaccination? What should be done for them?
4. Tom's father is a respiratory therapist in a hospital. Should he continue to work?

## SCENARIO FIVE

Poneyville, a city with a population of 1,200,000, experienced a measles epidemic involving 826 cases. The number hospitalized due to complications of measles was 281. Two unimmunized preschool-aged children died of complications of measles.

- **Learning Aids**

  1. Chart (below)
  2. Measles, mumps, and rubella — vaccine use and strategies for elimination of measles, rubella, and congenital rubella syndrome and control of mumps: recommendations of the Advisory Committee on Immunization Practices (ACIP); sections: Measles Outbreak Control, Measles Outbreaks Among Preschool-aged Children, Measles Outbreaks in Schools and Other Educational Institutions, and Table 1— Acceptable evidence of immunity to measles, rubella, and mumps. MMWR 1998; 47(RR-8): 1-57. http://www.cdc.gov/mmwr/PDF/RR/RR4708.pdf

- **Questions for Learners**

  1. What groups were at highest risk for measles?
  2. What role did the lack of age-appropriate MMR have in the outbreak?
  3. What role did measles vaccine failure have in the outbreak?
  4. Whom would you target for intervention?

**Poneyville Measles Cases**

| Age Group (years) | Vaccination Status of Measles Patients | | | Total Cases | Attack Rate per 100,000 |
|---|---|---|---|---|---|
| | Received 1 dose of MMR | No MMR but MMR indicated | No MMR but not indicated | | |
| <1 | — | — | 141 | 141 | 777 |
| 1-4 | 32 | 244 | 103 | 379 | 693 |
| 5-9 | 83 | 3 | 1 | 87 | 105 |
| 10-18 | 66 | 4 | 0 | 70 | 36 |
| 19-24 | 51 | 71 | 1 | 123 | 161 |
| >25 | 4 | 21 | 1 | 26 | 4 |
| Totals | 236 | 343 | 247 | 826 | 69 |

## SCENARIO SIX

Mildred is in your office today (in May) for a routine checkup. She is a 24-year-old nurse at a local college. Her vaccination record includes five doses of DTP, two doses of tetanus and diphtheria toxoids, adult type (Td), four doses of inactivated poliomyelitis virus vaccine (IPV), one dose of MMR, three doses of hepatitis B vaccine, and influenza vaccine last season. She had varicella (chickenpox) as a child. She is not taking any medications, including oral contraceptives. Her only allergy is to duck feathers; following exposure to duck feathers, she develops urticaria. She is single, sexually active, and not planning to become pregnant. Her last menstrual period was 3 weeks ago. She shares an apartment with her sister who has a congenital immune disorder.

- **Learning Aid**

  Measles, mumps, and rubella — vaccine use and strategies for elimination of measles, rubella, and congenital rubella syndrome and control of mumps: recommendations of the Advisory Committee on Immunization Practices (ACIP); sections: Dosage and Route of Administration, Precautions and Contraindications, and Table 1 — Acceptable evidence of immunity to measles, rubella, and mumps. MMWR 1998; 47(RR-8). http://www.cdc.gov/mmwr/PDF/RR/RR4708.pdf

- **Questions for Learners**

  1. Does Mildred need any vaccinations?
  2. Are vaccinations contraindicated without a pregnancy test, given that she is sexually active?
  3. Are vaccinations contraindicated for any other reason?
  4. What can a physicians do to ensure that their patients who have an occupational indication for MMR receive it?
  5. By which route is MMR administered?