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Control and Prevention of Rubella: Evaluation and Management of Suspected Outbreaks, Rubella in Pregnant Women, and Surveillance for Congenital Rubella Syndrome

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Control and Prevention of Rubella: Evaluation and Management of Suspected Outbreaks, Rubella in Pregnant Women, and Surveillance for Congenital Rubella Syndrome

Summary

Outbreaks of rubella continue to occur in the United States despite widespread use of the measles-mumps-rubella (MMR) vaccine. Throughout the mid- to late-1990s, rubella outbreaks were characterized by increased numbers of cases among adults born in countries that do not have or have only recently instituted a national rubella vaccination program. To address this change in disease epidemiology, CDC's National Immunization Program (NIP) developed the following recommendations in conjunction with public health officials in the field. Public health officials should implement appropriate responses to reports of suspected rubella to determine if an outbreak exists, evaluate its scope, and implement appropriate control measures. Health-care providers should be aware of the need for rubella prevention and control among women of childbearing age and of the appropriate follow-up for pregnant women exposed to rubella. Comprehensive surveillance for congenital rubella syndrome should begin during a rubella outbreak.

INTRODUCTION

Since the licensure of the rubella vaccine in 1969, the number of cases of rubella in the United States has decreased 99%, from 57,686 cases in 1969 to 271 cases in 1999 (CDC, unpublished data, 2000). The epidemiology of rubella changed in the 1990s, including shifts in the age distribution, ethnicity, and country of origin of patients, and in the setting of outbreaks. During the early 1990s, most rubella cases in the United States occurred among persons aged <15 years; since the mid-1990s, persons aged ≥15 years have accounted for most reported cases. In 1999, adults accounted for 86% of cases, an increase from 41% in 1990, and 73% of persons with rubella were Hispanic, compared with 4% in 1991 (CDC, unpublished data, 2000). Most of these persons were foreign-born. In recent rubella outbreaks, most cases occurred among persons from Mexico and Central America. Moreover, outbreaks occurred predominantly in workplaces and communities; before the mid-1990s, outbreaks occurred mainly in religious communities, schools, jails, and other closed environments. Recently, rubella outbreaks have been identified in poultry and meat processing plants that employ large numbers of foreign-born workers.

The number of cases of congenital rubella syndrome (CRS) has also declined, and CRS now disproportionately affects infants born to foreign-born women. During 1997–1999, a total of 21/26 (81%) infants reported with CRS were Hispanic, and 24/26 (92%) were born to foreign-born mothers (CDC, unpublished data, 2000). Although information on country of origin was not collected in 1991, a total of 8/42 (19%) infants with CRS were Hispanic. Identifying and managing susceptible pregnant women who might have been exposed to rubella is challenging, especially in communitywide outbreaks.

Congenital rubella infection (CRI) encompasses all outcomes associated with intrauterine rubella infection, including miscarriage, stillbirth, abortion, combinations of birth defects, or asymptomatic infection in the infant (also known as infection only) (*1*). Although serologic testing remains the most available laboratory method for confirmation, CRI also can be confirmed by reverse transcriptase polymerase chain reaction (RT-PCR) assays, which detect rubella virus (*2*).

Making best use of available technology will help rubella virus surveillance and ascertainment. For example, molecular typing of rubella virus is available to identify the origin of the virus as well as which virus strains are circulating. This information is necessary to document elimination of indigenous transmission. Universal programs to screen newborn hearing in the United States could help improve ascertainment of CRS cases because hearing impairment is the most common single defect associated with CRS (*3*). Performing serologic testing for rubella on infants who fail hearing screenings at birth could help identify CRS cases.

This report describes seven steps for evaluating and managing suspected rubella outbreaks. They were developed by NIP in conjunction with state and local public health officials based on experience with recent outbreaks in the United States (*4,5*). These steps are a) consider a single case of rubella a potential outbreak, b) confirm the diagnosis, c) conduct case investigations and vaccinate susceptible contacts, d) enhance active and passive surveillance measures, e) implement rubella control measures, f) conduct outreach in affected facilities and communities, and g) develop a plan for preventing future rubella outbreaks. This report also provides guidelines for evaluating and managing rubella in pregnant and nonpregnant women and evaluating infants for CRI.

BACKGROUND

Rubella is usually a mild febrile rash illness in adults and children. Other symptoms include lymphadenopathy, malaise, or conjunctivitis. Arthralgia and arthritis can occur in ≤70% of infected adult and adolescent females. Rare complications are thrombocytopenic purpura, encephalitis, neuritis, and orchitis. The incubation period for rubella is 12–23 days, and 20%–50% of rubella infections are asymptomatic. Persons with rubella are most infectious when rash is erupting, but can shed virus from 7 days before to 5–7 days after rash onset (i.e., the infectious period).

The most serious consequences of rubella result from infection during the first trimester of pregnancy. Rubella infection can affect all organs in the developing fetus and cause miscarriage, fetal death, and congenital anomalies. Up to 90% of infants born to mothers infected during the first 11 weeks of gestation will develop a pattern of birth defects called CRS (*6*); the rate of CRS for infants born to women infected during the first 20 weeks of pregnancy is 20%. Infants infected with rubella late in gestation do not exhibit clinical manifestations of CRS. Any infant infected with rubella in utero can shed virus for ≤1 year, sometimes longer (*7*).

The goal of the rubella vaccination program is to prevent the consequences of infection during pregnancy. Many countries do not have rubella vaccination programs or have only recently implemented such programs, and many adults throughout the world remain susceptible. In 1996, the World Health Organization (WHO) estimated that 36% of member countries offered routine rubella vaccination (*8*). In 1999, WHO estimated that 52% of countries offered routine rubella vaccination; in the Region of the Ameri-

cas, 89% of countries used rubella vaccine (*9*). Adults in the United States who were born in countries where routine rubella vaccination was not offered are at higher risk for contracting rubella and having infants with CRS compared with adults born in the United States. Vaccinating foreign-born, susceptible adults can be challenging because they might have little or no contact with the U.S. health-care system. Thus, health-care providers who treat foreign-born adults should document their rubella immunity with a written record of a rubella-containing vaccine or by serologic testing. If problems arise in translating vaccination records from other countries, help is available from the CDC Immunization Information Hotline at (800) 232-2522 (English) or (800) 232-0233 (Spanish). WHO also has summarized current global vaccination policies for countries throughout the world (*10*).

Adequate proof of rubella immunity includes a) written documentation of receipt of ≥1 dose of a rubella-containing vaccine administered on or after the first birthday, b) laboratory evidence of immunity, or c) birth before 1957 (except for women who could become pregnant). However, during an outbreak, persons born before 1957 should not automatically be considered immune to rubella. Rubella immunity is defined as a hemagglutination inhibition antibody titer of ≥1:8, a hemolysis in gel result of ≥10 international units (IU), or an optical density by enzyme-linked immunoassay (EIA) above the limit set by the manufacturer (*11*). Persons who do not meet the above criteria are considered susceptible.

REPORTING

Rubella and CRS became notifiable diseases in the United States in 1966 and 1969, respectively. All 50 states require reporting of rubella and CRS (*12*). For information on these requirements, contact local or state health departments.

State and local health departments rely on health-care providers, laboratory personnel, and other public health workers to report confirmed, probable, and suspected cases of rubella and CRS so the departments can monitor the occurrences of these diseases and facilitate appropriate control measures. Health-care providers and laboratory personnel who suspect cases of rubella, CRS, or congenital rubella infection only should report them within 24 hours to their local health department. Health-care providers should not delay reporting suspected cases of rubella, CRS, and congenital rubella infection only while they wait for laboratory confirmation.

Criteria for Rubella Case Classification

A clinical case of rubella is defined as an illness characterized by a) acute onset of generalized maculopapular rash; b) temperature >37.2 C (>99.0 F), if measured; and c) arthralgia/arthritis, lymphadenopathy (usually suboccipital, postauricular, and cervical), or conjunctivitis. Case classification for rubella is based on a clinical case definition and laboratory criteria for diagnosis (*13*). Cases are classified into one of the following categories:

- **Suspected.** Any generalized rash illness of acute onset.
- **Probable.** A case that meets the clinical case definition, has no or noncontributory serologic or virologic testing, and is not epidemiologically linked to a laboratory-confirmed case.

- **Confirmed.** A case that is laboratory confirmed or that meets the clinical case definition and is epidemiologically linked to a laboratory-confirmed case.
- **Asymptomatic Confirmed.** A laboratory-confirmed case in a person who is asymptomatic that also is epidemiologically linked to a laboratory-confirmed case clinically consistent with rubella (*14*).

Cases are also categorized by importation status:

- **Indigenous.** Any case that cannot be proved to be imported.
- **State-to-State Importation.** Requires documentation that a person either had face-to-face contact with a case of rubella outside the state or was out of the state for the entire period when he or she might have become infected (i.e., 14–23 days before rash onset).
- **International Importation.** A case that has its source outside the United States with onset of rash within 14–23 days of entry into this country.

Laboratory Diagnosis of Rubella

Laboratory diagnosis of rubella requires any one of the following:

- A positive serologic test for rubella immunoglobulin M (IgM) antibody. The preferred testing method for IgM is EIA, using the capture technique; indirect assays are acceptable (*15*). IgM antibodies might not be detectable before 4–5 days after rash onset, but they can persist for 6 weeks after rash onset. If negative results are obtained from a specimen taken before 4–5 days after rash onset, another specimen should be taken as soon as possible thereafter. Serum rubella IgM test results that are false positive have been reported in persons with other viral infections (e.g., acute infection with Epstein-Barr virus [infectious mononucleosis], recent cytomegalovirus infection, and parvovirus infection) or in the presence of rheumatoid factor. Patients with laboratory evidence of recent measles infection are excluded because concurrent infections are unlikely.
- A significant rise in serum rubella immunoglobulin G (IgG) antibody level between acute- and convalescent-phase titers by any standard serologic assay. Sera for IgG testing should be collected as early as possible (within 7–10 days) after onset of illness and again $\geq$7–14 days (preferably 2–3 weeks) later.
- Isolation of rubella virus from nasal, blood, throat, urine, or cerebrospinal fluid specimens (best results come from throat swabs). Specimens should be obtained as soon as possible (within 4 days) after rash onset. Efforts should be made to obtain clinical specimens for virus isolation from all patients (or from some patients in each outbreak) at the time of the initial investigation (*14*).
- Detection of virus by RT-PCR. This process can be used to detect the presence of rubella virus after growth in tissue culture or directly in clinical specimens.

Specimens submitted for rubella virus isolation or detection by RT-PCR can also be used for molecular typing. Molecular typing can help determine a) the origin of the virus, b) which virus strains are circulating in the United States, and c) whether these strains have become endemic in the United States. Specimens for molecular typing

should be obtained as soon as possible after diagnosis. Appropriate specimens include throat swabs and cerebrospinal fluid. Specimens for molecular typing should be sent to CDC as directed by the state health department. For information on the procedure for obtaining specimens, contact CDC's National Center for Infectious Diseases, Respiratory and Enterovirus Branch, Measles Virus Section at (404) 639-3512.

Laboratory Procedures for Persons Exposed to Rubella Who Do Not Have Rash

Persons exposed to rubella, particularly pregnant women, should be tested for rubella infection. Asymptomatic rubella infection can be diagnosed by a positive rubella-specific IgM antibody test or a significant rise in IgG antibody level between acute- and convalescent-phase tests. The acute-phase IgG serum specimen should be collected as soon as possible after exposure, whereas the convalescent-phase IgG specimen should be collected $\geq$7–14 days (preferably 2–3 weeks) later.

Case Classification Criteria for Congenital Rubella Syndrome*

CRS results from rubella infection in utero, usually manifests in infancy, and is characterized by clinical signs or symptoms from the following categories:

a) Cataracts/congenital glaucoma, congenital heart disease (most commonly patent ductus arteriosus or peripheral pulmonic stenosis), hearing impairment, pigmentary retinopathy.
b) Purpura, hepatosplenomegaly, jaundice, microcephaly, developmental delay, meningoencephalitis, radiolucent bone disease.

Infants with CRS usually present with more than one of these signs or symptoms. However, infants may present with a single defect. Hearing impairment is the most common single defect.

Case classification for CRS is based on clinical findings and laboratory criteria for diagnosis (*13*). Cases are classified as follows:

- **Suspected.** A case with some consistent clinical findings but not meeting the criteria for a probable case.
- **Probable.** A case that is not laboratory confirmed and that has any two findings listed in paragraph a) of the clinical description or one finding from paragraph a) and one from paragraph b), and lacks evidence of any other etiology.
- **Confirmed.** A clinically consistent case that is laboratory confirmed.
- **Infection Only.** A case that demonstrates laboratory evidence of infection, but without any clinical symptoms or signs.

CRS cases are also categorized by importation status:

- **Indigenous Case.** Any case that cannot be proved to be imported.
- **State-to-State Importation.** Requires documentation that the mother either had face-to-face contact with a case of rubella outside the state or was out of state for

*Most of the wording in this section comes directly from the case definitions developed by CDC and the Council of State and Territorial Epidemiologists (CSTE) (CDC. Case definitions for infectious conditions under public health surveillance. MMWR 1997;46[No. RR-10]:30).

the entire period when she might have become infected (14–23 days before rash onset or 21 days before conception and during the first 20 weeks of gestation).

- **International Importation.** Defined as CRS in a U.S. or non-U.S. citizen whose mother was outside the United States for the entire period when she may have had exposure to rubella (21 days before conception and during the first 20 weeks of gestation), or who has known exposure to rubella risks outside the United States.

Laboratory Diagnosis of Congenital Rubella Syndrome and Congenital Rubella Infection Only

Laboratory diagnosis of CRS or congenital rubella infection only requires any one of the following:

- Demonstration of a rubella-specific IgM antibody or infant IgG rubella antibody level that persists at a higher level and for a longer time than expected from passive transfer of maternal antibody (i.e., rubella titer that does not drop at the expected rate of a twofold dilution per month). Approximately 20% of infected infants tested for rubella IgM might not have detectable titers before age 1 month (L.Z. Cooper, M.D., Columbia University, oral communication, 1998). Thus, infants with symptoms consistent with CRS who test negative soon after birth should be retested at age 1 month.
- Isolation of rubella virus, which can be obtained from nasal, blood, throat, urine, or cerebrospinal fluid specimens (best results come from throat swabs). Efforts should be made to obtain clinical specimens for virus isolation from infants at the time of the initial investigation. However, infants with CRS and congenital rubella infection only shed virus and are considered infectious for a prolonged period. Children with CRS should be presumed infectious at least through age 1 year unless nasopharynx and urine cultures are negative for virus after age 3 months. Some authorities suggest that an infant with CRS should be considered infectious until two cultures of clinical specimens obtained 1 month part are negative for rubella virus.
- Detection of virus by RT-PCR. This process can be used to detect the presence of rubella virus after growth in tissue culture or directly in clinical specimens.

Specimens for molecular typing should be obtained from infants with CRS as soon as possible after clinical diagnosis. Appropriate specimens include throat swabs, cerebrospinal fluid, and cataracts from surgery. Specimens for molecular typing should be sent to CDC as directed by the state health department.

RECOMMENDATIONS

The seven steps described in this section are recommended for the evaluation, management, and surveillance of suspected rubella outbreaks (Box). They are based on recent experience with outbreaks in the United States (*4,5*). These recommendations can be used in settings beyond those discussed in this report.

BOX. Summary of the seven steps for evaluating and managing suspected outbreaks of rubella

- Consider a single case of rubella a potential outbreak.
- Confirm the diagnosis.
- Conduct case investigations and vaccinate susceptible contacts.
- Enhance active and passive surveillance measures.
- Implement rubella control measures.
- Conduct outreach in affected facilities and communities.
- Develop a plan for preventing future rubella outbreaks.

Consider a Single Case of Rubella a Potential Outbreak

Because the incidence of rubella is low in the United States, health agencies should consider even one case a potential outbreak. Rubella is an infectious disease for which 20%–50% of cases are asymptomatic, and investigation of an apparently isolated case could reveal additional cases. Rubella transmission can occur in congregate settings such as households, workplaces, universities, jails, or communities. The type and size of the outbreak determines the magnitude of the response.

Most recent rubella outbreaks were first identified in the workplace. Facilities that employ many foreign-born workers (e.g., meat or poultry processing plants) are at greater risk for rubella outbreaks than those with mostly workers born in the United States. Initial reports can come from on-site health-care providers who have recently seen rash illness among employees.

Steps to Improve Ascertainment of Rubella Cases in the Workplace

- Search on-site medical logs for rash illness and payroll or sick leave documentation for workers who might have been absent because of illness.
- Conduct follow-up interviews with workers who have been sick and contacts to determine history of recent rash illness.

Steps to Improve Ascertainment of Rubella Cases in the Community

Recently, investigations of workplace outbreaks have revealed spread to the community. The following steps can help identify cases in the community:

- Review the community demographics to determine if there are groups at high risk for not being vaccinated (e.g., foreign-born persons or members of religious communities opposed to vaccination).
- Search medical records of the community's health-care providers and hospital emergency rooms.
- Contact schools and day care centers to identify absences caused by rash illness.

- Conduct thorough follow-up investigation of patient contacts, including household residents, students, and teachers.

Confirm the Diagnosis

Because rubella has many symptoms in common with other rash illnesses, laboratory confirmation is required for case confirmation. Laboratory testing should be conducted for all suspected cases of rubella. IgM antibodies might not be detectable before 4–5 days after rash onset. If negative rubella IgM and IgG results are obtained from specimens taken before 4–5 days, repeat serologic testing (*14*).

Conduct Case Investigations and Vaccinate Susceptible Contacts

Case investigation and identification of contacts should be conducted for all suspected cases of rubella. In addition, asymptomatic confirmed cases should be investigated and contacts identified. A descriptive analysis of an outbreak allows health agencies to focus control measures — especially vaccination — on persons most in need. Cases of rubella occurring in vaccinated persons within 7–10 days after vaccination should be investigated, and specimens should be obtained for virus isolation to determine if rash is attributable to vaccine virus or wild virus.

Any direct contact with a patient with rubella during the infectious period (i.e., 7 days before to 5–7 days after rash onset) is defined as exposure. Contact can include (but is not limited to) living in the same household, attending the same class or social function, or working side-by-side on a production line. Although rubella transmission is usually associated with repeated exposure, transmission has been documented after a single exposure.

Depending on resources available, investigation of contacts of patients with rubella might need to be prioritized based on the probability of transmission. The first priority should be persons who share households or persons in a congregate environment who share space (e.g., side-by-side workers on a production line) with a patient. The second priority should be persons who share or have shared environments with a potential for contact (e.g., places of worship, parties, social gatherings), but who did not knowingly have direct contact with a patient. If resources allow, investigation of contacts can be extended to geographic areas or groups at risk where disease has been documented.

Every effort should be made to identify all susceptible pregnant women who might have been exposed to a patient and test them for rubella immunity. For example, in a workplace outbreak, pregnant women who have contact with patients (including coworkers and household contacts) should be evaluated for rubella immunity. In communitywide outbreaks, health-care workers who treat pregnant women should be alerted to the outbreak and advised to verify rubella immunity in pregnant women.

Steps for Locating Exposed Contacts for Further Investigation

- Record symptom onset date and infectious period for patients on a calendar to determine in what setting the exposure might have occurred, where to look for other exposed persons, and who suspected patients had contact with during their

infectious period. For example, if a person had rash onset January 26, exposure would have occurred 12–23 days earlier (i.e., January 3–14). The patient would have been infectious from 7 days before to 5–7 days after rash onset (i.e., January 19–February 3). Consider asymptomatic confirmed patients infectious 5–30 days after the last exposure.

- Use the calendar to list contacts identified during the infectious period.
- Follow up with contacts to assess symptoms of rubella-like illness, determine susceptibility, and vaccinate susceptible persons without adequate proof of immunity and who have no contraindications to rubella vaccine.
- Continue to investigate contacts of subsequently identified patients. (See Rubella Prevention and Control Among Women of Childbearing Age for information on follow-up of pregnant contacts.)

Information That Should be Obtained from Patients With Rubella

- Name, address, and telephone number(s) to reach the patient after the initial interview, if necessary.
- Demographic information, including country of origin, length of time in the United States, and length of time in the state where the rubella diagnosis was made.
- Primary language spoken.
- Clinical details, including the following:
  - — Date of onset and duration of rash.
  - — Presence of other symptoms (e.g., fever, arthralgia/arthritis, lymphadenopathy, conjunctivitis) and date of onset.
  - — Complications (e.g., encephalitis, thrombocytopenia, death).
- Vaccination status, including the following:
  - — Number of doses of rubella vaccine.
  - — Dates of vaccination.
  - — If not vaccinated, reason for nonvaccination.
- Risk factors for disease, including the following:
  - — Contact with a probable or confirmed patient or a person with a rash illness suspected of being rubella.
  - — Transmission setting (e.g., day care center, school, workplace, place of worship, athletic event, or other congregate or social gathering).
  - — Relationship to outbreak (i.e., whether case is sporadic or part of an identified outbreak).
  - — Travel history.

— Contact with others who have recently traveled (i.e., import status [indigenous, state-to-state, or international], state name, and country name [and state within the country]).

- Information regarding contacts during the infectious period (i.e., 7 days before to 5–7 days after rash onset), including the following:

  — List of persons with household contact (e.g., residents and others with close contact in the home) and persons with contact in a congregate environment with shared space.

  — List of women who are pregnant who have had contact with a patient with rubella.

  — Rubella symptoms (e.g., rash, fever, lymphadenopathy) of contacts.

  — Place of employment of contacts.

- Laboratory information, including the following:

  — Date and source of specimen sent for viral culture (e.g., throat, urine, blood).

  — Viral culture results (positive or negative for rubella virus).

  — Serologic test results for serum rubella IgM or IgG, with specific titer results when applicable (e.g., 1:256). A positive serum rubella IgM or a significant rise between acute- and convalescent-phase IgG titers indicates an acute infection.

- Pregnancy status of female patients, including the following:

  — Whether pregnant.

  — If patient is pregnant, obtain information regarding a) number of weeks of gestation at onset of illness; b) previous evidence or date of serological immunity; c) previously diagnosed rubella infection and date; d) date and specific titer result of previous serum rubella IgG titer; and e) pregnancy outcome, when available.

Enhance Active and Passive Surveillance Measures

For this step, outbreak investigators should institute surveillance measures designed to identify cases prospectively, as well as any cases with rash onset that preceded the first identified case. Because some persons with rubella do not have rash, these measures should use a broader definition of suspected cases (e.g., fever with lymphadenopathy or arthralgia/arthritis in adult women) in areas where rubella cases have been confirmed. Broadening the case definition and investigating suspected cases could lead to more complete ascertainment.

Components of Surveillance for Rubella in an Outbreak Setting

- Identify health-care providers and facilities serving populations at risk and involve them in surveillance.

- Identify workplaces with large numbers of persons who might lack rubella immunity and involve them in surveillance.
- Identify day cares, schools, places of worship, and community organizations (particularly in neighborhoods where many residents might lack rubella immunity) and involve them in surveillance.
- Promote awareness among health-care providers that rubella and CRS still occur in the United States among certain groups that lack rubella immunity.
- Distribute written guidelines instructing health-care providers to obtain appropriate serology and specimens and to notify health departments of all suspected rubella cases.
- Establish routine contact (e.g., daily or weekly) with hospitals, doctors' offices, clinics, schools, and laboratories to obtain reports of persons with rash illness or other symptoms indicative of rubella.

In addition to prospective surveillance, retrospective case finding should be conducted for 6 weeks (i.e., two incubation periods) before the first identified case. If evidence indicates that the outbreak was in progress during this time, retrospective case finding should continue until no further cases are identified.

Steps to Identify Cases Retrospectively

- Review medical records in health-care settings, including doctors' offices, for rubella-like illness.
- Review workplace or school absentee logs.
- Review records of laboratories that conduct testing for the area.

Implement Rubella Control Measures

During a rubella outbreak, the following control measures should be taken:

- Isolate patients for 5–7 days after rash onset.
- Identify and vaccinate susceptible persons who have no contraindications to rubella vaccine.
- Ensure that pregnant women who are exposed to rubella and do not have adequate proof of immunity are serologically evaluated for rubella-specific IgM and IgG antibodies (see Laboratory Diagnosis of Rubella).
- Counsel susceptible pregnant women regarding the risks for intrauterine rubella infection and recommend that they restrict their contact with persons with confirmed, probable, or suspected rubella for $\geq$6 weeks (two incubation periods) after rash onset in the last identified patient. Pregnant women should also be advised to avoid activities where they might be exposed to rubella for 6 weeks (two incubation periods) after the onset of symptoms of rubella in the last patient for whom rubella cannot be ruled out to minimize their chances of coming in contact with persons with symptomatic or asymptomatic rubella infection (see Rubella Prevention and Control Among Women of Childbearing Age).

Control Measures for Specific Settings

Congregate Environments. Congregate environments include households, jails, day cares, schools, military settings, workplaces, places of worship, athletic events, and other social gatherings. Control measures recommended for these settings are as follows:

- Refer persons without adequate proof of rubella immunity for vaccination or offer on-site vaccination clinics. After vaccination, these persons no longer need to restrict contact. The exception is health-care workers (see Health-Care Settings).
- Isolate patients during their infectious period (i.e., 5–7 days after rash onset). Recommend that patients restrict contact with pregnant women and persons without adequate proof of rubella immunity for 5–7 days after rash onset.
- Recommend for day cares and schools that persons exempt from rubella vaccination for medical, religious, or other reasons be excluded from attendance for 3 weeks after onset of rash in the last reported patient in the outbreak setting.
- Recommend that all susceptible persons who were not vaccinated as part of the control efforts (e.g., those who refused vaccination or who had contraindications to vaccine) minimize contact with patients for 5–7 days after rash onset.
- Recommend that susceptible pregnant women not attend activities, particularly in the first trimester of pregnancy, where they might be exposed to rubella for ≥6 weeks (two incubation periods) after the onset of symptoms of rubella in the last patient for whom rubella cannot be ruled out to minimize their chances of coming in contact with persons with asymptomatic rubella infection.

Health-Care Settings. Health-care settings include hospitals, doctors' offices, clinics, nursing homes, and other facilities where patients receive subacute or extended care. Control measures recommended for these settings include excluding and vaccinating health-care workers without adequate evidence of immunity, particularly in settings where pregnant women could be exposed.

All persons who work in health-care facilities or who have contact with any patients should be immune to rubella. Any exposed health-care worker who does not have adequate evidence of immunity should be excluded from duty beginning 7 days after exposure to rubella and continuing through either a) 21 days after last exposure or b) 5–7 days after rash appears. Susceptible, exposed health-care workers who are vaccinated should be excluded from direct patient care for 23 days (i.e., the longest incubation period) after the last exposure to rubella because no evidence exists that postexposure vaccination is effective in preventing rubella infection in persons already infected at the time of vaccination. Because birth before 1957 does not guarantee immunity, health-care facilities should strongly recommend a dose of MMR vaccine to workers born before 1957 who do not have serologic evidence of immunity.

Communitywide Rubella Outbreaks. When communitywide outbreaks occur, the following steps are recommended:

- Attempt to ensure proper isolation procedures for all patients. In general, any person exposed to a patient with rubella or CRS who cannot demonstrate proof of immunity should receive vaccine or restrict contact with patients with rubella or CRS.

- Make every effort to identify and test all exposed pregnant women. In communitywide outbreaks, health-care workers who treat pregnant women should be alerted to the outbreak and advised to verify rubella immunity in pregnant women (see Rubella Prevention and Control Among Women of Childbearing Age).

Conduct Outreach in Affected Facilities and Communities

Outreach activities should begin during the outbreak investigation and should convey the seriousness of rubella infection and the importance of rubella vaccination and other control efforts. Outreach activities also provide an opportunity to reinforce the importance of persons seeking medical advice for rubella-like illnesses and of health-care workers reporting rubella.

Workplace

In the workplace, outreach activities should focus on educating workers and employers regarding rubella and its consequences, using such strategies as educational sessions, flyers, letters, and E-mail. Stress that persons who work in a place where an outbreak is in progress and who live with or have contact with someone who is pregnant should be vaccinated unless known to be immune.

Community

A communitywide outbreak can be most effectively contained if public health agencies form partnerships with community leaders, health-care providers, and groups with a history of effective community involvement. These persons can act as liaisons between public health agencies and the community. Outreach activities in the community should include the following:

- Identifying persons in the community who can serve as liaisons between public health agencies and the local population (e.g., community activist groups, members of the foreign-born community, health-care workers who treat migrant populations, and leaders in places of worship).
- Training these liaisons on the current epidemiology and clinical symptoms of rubella, as well as laboratory testing methods (for health-care providers). Stress the importance of vaccinating persons who are susceptible to rubella, particularly persons who live in households with pregnant women or any women of childbearing age.
- Working with liaisons to develop targeted education messages and materials that address community members' beliefs regarding health care. Distribute messages and materials where community members who are at risk are likely to have access to them.
- Encouraging liaisons to participate in surveillance activities (e.g., they could be aware of persons in community organizations who have missed activities because of illness).
- Establishing vaccination sites in areas frequented by the local population (e.g., places of worship, day labor pick-up sites, worksites, or places where special

celebrations are held) and providing counseling on the importance of rubella vaccination. Bilingual personnel might be needed to serve as counselors and investigators at these sites.

Develop a Plan for Preventing Future Rubella Outbreaks

Prevention of future rubella outbreaks includes ensuring high levels of rubella immunity, vaccinating susceptible persons, maintaining rubella and CRS surveillance and reporting, and preparing an appropriate and rapid response when a case of rubella is identified. To make the most effective use of resources to prevent CRS and control rubella, state and local health authorities might want to identify and prioritize counties and communities in order of decreasing risk and conduct vaccination or education campaigns accordingly. Depending on cost and available resources, health department personnel might decide to target all counties and communities in the state or limit the campaigns to those at highest risk for rubella outbreaks based on known or suspected susceptibility patterns and the likelihood of introduction of rubella into the community. Based on the current epidemiology of rubella, counties most at risk appear to be those with substantial numbers of adolescents and young adults born and raised in countries that do not have a history of routine rubella vaccination.

All states should conduct activities for the prevention of CRS or CRI, including the following:

- Identifying women of childbearing age at risk for rubella infection and ensuring immunity in women by enhancing existing programs (e.g., prenatal testing and postpartum vaccination). Approximately 50% of CRS cases could be prevented through postpartum vaccination of women known to be susceptible to rubella (*16*).
- Maintaining rubella surveillance and investigating contacts of patients appropriately.
- Providing ethnically and linguistically appropriate rubella educational materials where persons susceptible to rubella might congregate (e.g., worksites, health clinics, WIC* centers, and community centers).
- Ensuring that MMR vaccine is available to providers through the Vaccines for Children (VFC) program or the 317 Immunization Grant Program (under the Public Health Service Act). For more information on these programs, contact CDC's National Immunization Program, Immunization Services Division, Program Operations Branch at (404) 639-8215.

In addition, states that have had recent rubella outbreaks or a recent indigenous CRS case or that have identified populations at high risk for rubella outbreaks might want to emphasize rubella control as well as CRS prevention through the following activities:

- Ensuring immunity among all persons (male and female), especially foreign-born persons who are not likely to have received rubella vaccination.

*Special Supplemental Nutrition Program for Women, Infants, and Children.

- Educating providers, especially VFC providers, regarding the potential increased risk for rubella susceptibility among foreign-born persons and ensuring that providers recommend vaccine for susceptible persons.

At workplaces where recent rubella outbreaks have occurred or high numbers of persons at risk for rubella are employed, state health departments should

- educate management and workers regarding the risks for rubella and CRS.
- recommend that all employees susceptible to rubella receive MMR vaccine.
- recommend that rubella immunization be provided in the workplace. Some states might consider conducting projects to demonstrate the feasibility of rubella immunization in the workplace.
- ensure that workers who are vaccinated receive personal immunization record cards.
- ensure that family members and close personal contacts of susceptible workers are referred to the health department or other provider for immunization.

In communities that have had recent rubella outbreaks or where large numbers of persons at risk for rubella reside, state health departments should

- identify leaders in communities at risk to serve as spokespersons for rubella control and CRS prevention programs;
- work with community groups (i.e., civic or faith-based organizations) to conduct education programs and vaccination campaigns;
- encourage employers to establish a rubella screening and vaccination program for all current and new employees; and
- provide necessary vaccines for group members at risk identified in public health clinics.
- alert other state health departments of rubella outbreaks, particularly those with evidence of state-to-state importation.*

VACCINE

This section summarizes information available in the most recent ACIP statement on MMR vaccination (*17*). In the United States, most rubella vaccination is administered as part of the MMR vaccine. Approximately 21–28 days are required for development of protection following vaccination.

Persons generally are presumed immune to rubella if they a) have documentation of vaccination with ≥1 dose of MMR or other live, rubella-containing vaccine administered on or after the first birthday, b) have laboratory evidence of immunity, or c) were born before 1957 (except women who could become pregnant). Susceptible adults born after 1957 who do not have a medical contraindication should receive ≥1 dose of MMR

*CSTE recommends that states use CDC's *Epidemic Information Exchange* (*Epi-X*) to disseminate outbreak information. Information on *Epi-X* is available at <http://www.cdc.gov/programs/research5.htm>.

vaccine for protection against rubella and two doses ≥1 month apart if at high risk for exposure to measles (*17*). Birth before 1957 is not acceptable evidence for rubella immunity for women who could become pregnant.

Contraindications and Precautions

Following is a summary of contraindications and precautions for administration of MMR vaccine. For more detailed information, consult the most recent ACIP statement on MMR vaccination (*17*).

Allergic Reactions

MMR vaccine should not be administered to persons who have experienced severe allergic reactions to a previous dose of a rubella-containing vaccine or to a vaccine component (e.g., gelatin or neomycin). Allergy to egg is not a contraindication.

Pregnancy

MMR vaccine should not be administered to women known to be pregnant or attempting to become pregnant. Because of the theoretical risk to the fetus, women should be counseled to avoid becoming pregnant for 3 months after receipt of a rubella-containing vaccine (*18*). If a pregnant woman is vaccinated or becomes pregnant within 3 weeks after receipt of vaccine, she should be counseled regarding the theoretical basis of concern for the fetus. However, receipt of rubella-containing vaccine during pregnancy should not ordinarily be a reason to consider termination of pregnancy. Women who are susceptible to rubella and not vaccinated because they are pregnant or might become pregnant within the next 3 months should be advised regarding the potential risk for CRS and the importance of being vaccinated as soon as they are no longer pregnant (*17*).

From January 1971 through April 1989, CDC followed to term 321 known rubella-susceptible women who were vaccinated within 3 months before or 3 months after conception. Ninety-four women received HPV-77 or Cendehill vaccines, one received vaccine of unknown strain, and 226 received RA 27/3 vaccine (the only rubella vaccine presently used in the United States). None of the 324 infants born to these mothers had malformations compatible with CRI, but five had evidence of subclinical rubella infection, two of whom were exposed to RA 27/3 vaccine (*17*). Based on these data, the estimated risk for serious malformations attributable to RA 27/3 vaccine ranges from zero to 1.6% (*17*). Breast-feeding is not a contraindication to receiving MMR vaccine.

Immunodeficiency

MMR vaccine should not be administered to persons with severe immunodeficiency from any cause. Persons with mild immunosuppression (e.g., from asymptomatic human immunodeficiency virus [HIV] infection or short-term or low-dose steroid use) may be vaccinated.

Illness

Health-care providers should evaluate whether to administer MMR vaccine to

- persons with moderate or severe illness. Minor illnesses (e.g., otitis media or mild upper respiratory tract infection) are not contraindications for receipt of vaccine.

- persons with history of thrombocytopenia. The decision to vaccinate should depend on the benefits of immunity to measles, mumps, and rubella compared with the risks for recurrence or exacerbation of thrombocytopenia either after vaccination or during natural infection with measles or rubella.
- persons who have received high doses of immunoglobulins. Recent evidence indicates that high doses of immunoglobulins can inhibit the immune response to rubella vaccine for ≥3 months.

Vaccine Information Statements (VIS)

The National Childhood Vaccine Injury Act (NCVIA) requires all health-care providers in the United States who administer MMR vaccine to provide a copy of the relevant VIS to either an adult vaccinee, or in the case of a minor, to a parent or legal representative (*18*). Health-care providers are not required to obtain the signature of the patient, parent, or legal representative acknowledging receipt of the VIS. However, to document that the VIS was given, health-care providers must note in each patient's permanent medical record at the time a VIS is provided the date printed on the VIS and the date the VIS is administered to the vaccine recipient, parent, or legal representative. NCVIA also requires that health-care providers note the following information in the patient's permanent medical record:

- The date of administration of the vaccine.
- The manufacturer and lot number of the vaccine.
- The name and address of the health-care provider administering the vaccine (i.e., the address where the record is kept; if vaccinations are administered in a shopping mall, for example, the address should be the clinic where the permanent record will reside).

Reporting of Adverse Events

The National Vaccine Injury Act of 1986 requires physicians and other health-care providers who administer vaccines to maintain permanent immunization records and to report occurrences of adverse events for selected vaccines (*17*). Serious adverse events (i.e., all events requiring medical attention), regardless of whether they are suspected to have been caused by vaccine, should be reported to the Vaccine Adverse Event Reporting System (VAERS). VAERS forms and instructions are available in the *FDA Drug Bulletin* and the *Physicians' Desk Reference* or by calling the 24-hour VAERS information recording at (800) 822-7967.

RUBELLA PREVENTION AND CONTROL AMONG WOMEN OF CHILDBEARING AGE

Guidelines for rubella prevention and control among women of childbearing age differ depending on the likelihood of exposure to rubella. Identifying women who could have been exposed is critical so they can receive appropriate testing and follow-up. Guidelines for testing and follow-up for all women of childbearing age, pregnant women

for whom rubella exposure is unlikely, and pregnant women who might have been exposed to rubella are outlined in the following sections.

All Women of Childbearing Age

Health-care providers who treat women of childbearing age should routinely determine rubella immunity and vaccinate those who are susceptible and not pregnant. Proof of immunity can be either a verified record of vaccination or a positive IgG antibody serologic test. Rubella-susceptible women who a) do not report being pregnant, b) are not likely to become pregnant in the next 3 months, and c) do not have other contraindicating conditions should be vaccinated. Before vaccination, each patient should be counseled to avoid pregnancy for 3 months after vaccination because of the theoretical risk for vaccine virus affecting the fetus. Because routine pregnancy screening is not recommended before rubella vaccination, patients should be counseled regarding the theoretical risk to the fetus from inadvertent vaccination of a pregnant woman.

Pregnant Women Without Likely Exposure

Even when no outbreaks have been reported and no rubella exposure has occurred, health-care providers should routinely conduct a rubella IgG test for all pregnant women at the earliest prenatal visit. A positive rubella IgG antibody test indicates rubella immunity, and health-care providers can assume that immunity was acquired before pregnancy. Women who are found to be susceptible should be monitored for signs of rubella during pregnancy and vaccinated postpartum. Susceptible pregnant women should be advised to avoid contact with persons with rash illness.

An IgM test should not be used to determine rubella immune status; IgM is used to diagnose acute and recent rubella infection. The TORCH (i.e., toxoplasmosis, rubella, cytomegalovirus, and herpes) panel includes a test for rubella IgG antibodies as well as a test for rubella IgM antibodies. Because of the potential for false-positive IgM results, a TORCH panel should not be used to determine rubella immunity. Rubella IgM testing should be performed on pregnant women who report symptoms of rubella or susceptible pregnant women who might have been exposed to rubella to rule out acute or recent infection.

Screening and Follow-Up of Pregnant Women Who Might Have Been Exposed to Rubella

Because the consequences of rubella infection during pregnancy are serious, every effort must be made to identify all women of childbearing age exposed to a person with confirmed, probable, or suspected rubella. Women found to be susceptible and not pregnant should be vaccinated as outlined previously (see All Women of Childbearing Age). Susceptible household contacts of pregnant women should also be vaccinated.

All exposed pregnant women should be screened to determine if they a) were infected during pregnancy, b) are susceptible, or c) were immune before pregnancy. Because of the seriousness of CRI, immunity must be documented by a verified, dated record of a positive serologic test. Pregnant women without documented immunity should be tested for the presence of rubella IgG and IgM antibodies as outlined in this

section. Identifying susceptible pregnant women is critical, so they can be isolated from further exposure, monitored for infection, and vaccinated postpartum. Pregnant women with evidence of infection during pregnancy should be evaluated to verify rubella infection and determine gestational age at time of infection, if possible, to assess the possibility of risk to the fetus.

Immunoglobulin (IG) does not prevent rubella or mumps infection after exposure and is not recommended for that purpose (*18*). Administration of IG after exposure to rubella will not prevent infection or viremia, but might modify or suppress symptoms and create an unwarranted sense of security. Therefore, IG is not recommended for routine postexposure prophylaxis of rubella in early pregnancy or any other circumstance. Infants with congenital rubella have been born to women who received IG shortly after exposure. Administration of IG should be considered only if a pregnant woman who has been exposed to rubella will not consider termination of pregnancy under any circumstances. In such cases, intramuscular administration of 20 mL of IG within 72 hours of rubella exposure might reduce — but will not eliminate — the risk for rubella.

During an outbreak, the following steps should be taken to evaluate and follow up with pregnant women who had contact with a person with confirmed, probable, or suspected rubella:

- Use documented serologic test results to verify immunity. If unavailable, conduct rubella IgG and IgM antibody testing regardless of symptom history. Pregnant women who are exposed to rubella and who do not have documented proof of immunity should be tested for rubella-specific IgM antibodies to identify recent infection. Because 20%–50% of rubella cases are asymptomatic, this testing policy is crucial to assess the possibility of risk to the fetus. Another way to identify recent infection is to detect a significant rise in paired IgG serum. A single positive IgG test indicates rubella immunity, but does not give information regarding the timing of the infection. However, a significant rise in IgG antibody (determined by testing paired sera) or positive IgM antibody test indicates recent infection.

- Recommend restricting activities to avoid exposure while waiting for serologic test results. During this time, pregnant women should be excluded from activities (e.g., work or school) that present the possibility of exposure to persons with confirmed or suspected cases of rubella. Pregnant women found to be susceptible to rubella should avoid these settings for 6 weeks (two incubation periods) after the onset of symptoms of rubella in the last patient for whom rubella cannot be ruled out.

- Evaluate exposed pregnant women with positive IgG titers and negative IgM to determine if they acquired immunity before pregnancy or infection during pregnancy. Women without previously documented immunity who were exposed during pregnancy and >6 weeks before IgM testing could test negative for IgM antibodies, which are normally not detectable >6 weeks after infection. Thus, a negative rubella IgM antibody assay does not rule out infection during pregnancy. The dates of the pregnancy, possible exposures, test(s), and history of rash illness should be considered in assessing the possibility of risk to the fetus.

- Evaluate pregnant women with confirmed rubella to assess risk to the fetus. Rubella infection during the first 3 months of pregnancy is associated with the

greatest risk for CRI, and up to 90% of infants born to mothers infected during the first 11 weeks of gestation will develop CRS. Infection late in the first half of pregnancy is more likely to result in hearing impairment and less likely to be associated with other defects. Although not likely to result in CRS, rubella infection late in pregnancy can result in congenital rubella infection only.

- Pregnant women with negative IgG and negative IgM on first testing should be retested in 10–14 days; the first specimen should be reanalyzed along with the second specimen. A significant rise in IgG or positive IgM indicates recent infection. If a susceptible pregnant woman continues to be directly exposed to rubella, repeat tests of paired sera in 10–14 days to determine if infection occurs, then every 3–4 weeks if exposure continues. Testing can be performed earlier if pregnancy outcome might be influenced. Evaluate the infant on delivery for signs of CRS, and vaccinate the mother postpartum.
- Recommend restricting activities for susceptible women (i.e., those without detectable IgG and IgM antibodies), obtain follow-up serologic testing, and vaccinate after delivery. Susceptible pregnant women should be excluded from activities (e.g., work or school) that present the possibility of exposure to persons with confirmed or suspected cases of rubella. Pregnant women found to be susceptible should avoid these settings for 6 weeks (two incubation periods) after the onset of symptoms of rubella in the last patient for whom rubella cannot be ruled out. Household contacts or other ongoing contacts without documented rubella immunity should be vaccinated.
- Evaluate asymptomatic, exposed pregnant women with documented history of previous rubella immunity. Rubella reinfection is rare but has been documented (*19–22*). Women with documentation of previous rubella immunity who are exposed to rubella during pregnancy should consult their physicians. After discussing the potential for reinfection, physicians might recommend acute- and convalescent-phase IgG antibody testing or an IgM antibody test to document whether reinfection has occurred. However, the potential for false-positive IgM tests exists, and the potential risks and benefits of testing should be considered.
- Counsel pregnant women with documentation of previous immunity to seek medical attention promptly if rubella-like symptoms appear. Any pregnant woman with documented immunity and rubella-like symptoms should be immediately evaluated by a physician to diagnose the symptoms and ensure the health of the mother and fetus.

SURVEILLANCE FOR CONGENITAL RUBELLA SYNDROME

Consequences of CRI during pregnancy include abortion, miscarriage, stillbirth, and a pattern of birth defects called CRS. The most common congenital defects related to CRS are cataracts, heart defects, hearing impairment, and developmental delay. Other less specific signs and symptoms of CRS include purpura, hepatosplenomegaly, jaundice, microcephaly, meningoencephalitis, and radiolucent bone disease.

Pregnant women with known rubella exposure should receive follow-up care. Surveillance for CRI and CRS should be implemented when confirmed or probable rubella

cases are documented in a setting where pregnant women might have been exposed. The following steps are recommended to achieve these goals:

- Follow the outcome of pregnancy for pregnant women with confirmed or suspected rubella infection and for susceptible pregnant women with rubella exposure. A state or local registry of pregnant women with confirmed or suspected rubella should be established to record pregnancy outcomes (e.g., abortion, stillbirth, congenital rubella-associated defects) and laboratory evaluation of infants. Because hearing impairment, cataracts, and heart defects are common among infants with CRS, hearing and vision evaluations for infants born to susceptible, pregnant women exposed to rubella could help identify cases and aid early diagnosis and intervention.
- Educate and heighten awareness among health-care providers. Health-care providers in the area of an outbreak should be made aware of the potential for CRS births in their facilities and given information regarding the physical manifestations of CRS and appropriate laboratory testing for infants with suspected CRS. The classic presentation for CRS is cataracts, hearing impairment, and congenital heart disease (especially patent ductus arteriosus or peripheral pulmonic stenosis). Some conditions associated with CRS (e.g., hearing impairment and developmental delay) might not be apparent at birth.

The following steps are recommended for follow-up and surveillance for CRS and congenital rubella infection only cases:

- Discuss appropriate isolation procedures for infants with CRS and congenital rubella infection only with health-care providers. Only persons immune to rubella should have contact with these infants. Children with CRS should be presumed infectious at least through age 1 year unless nasopharynx and urine cultures are negative for virus after age 3 months. Some authorities suggest that an infant with CRS should be considered infectious until two cultures of clinical specimens obtained 1 month part are negative for rubella virus.
- Use universal newborn hearing screening programs to help detect CRS, where available. Approximately 50% of states have such programs, some of which use a combination of evoked otoacoustic emissions and auditory brainstem response to identify hearing impairment in newborns. Because hearing impairment is the most common single defect associated with CRS, newborns who fail hearing screening tests should be tested for rubella-specific IgM antibodies to rule out CRS.
- Confirm the CRS or congenital rubella infection only diagnosis with laboratory testing (see Laboratory Diagnosis of Congenital Rubella Syndrome and Congenital Rubella Infection).
- Report all CRS and congenital rubella infection only cases to the state health department as soon as they are suspected, even though laboratory confirmation might be pending. State health departments should then report cases to CDC's Rubella Activity at (404) 639-8230. Cases are then entered into the National Congenital Rubella Syndrome Registry. The following data are epidemiologically important and should be collected during case investigations (additional information can be collected at the direction of the state health department):

— Demographic information.

— Maternal history, including a) date of rubella vaccination(s), b) dates and results of previous serologic tests for rubella immunity, c) history or documentation of rubella infection during pregnancy, d) history of pregnancies inside and outside the United States, e) country of birth and length of residence in the United States, and f) history of exposure to rubella and travel.

— Clinical details (e.g., cataracts, hearing impairment, developmental delay, type of congenital heart defect, meningoencephalitis, microcephaly).

— Laboratory information, including types and results of laboratory testing performed on both mother and child.

- Recommend consultation with specialists for infants with CRS, as appropriate, based on clinical manifestations.

CONCLUSION

Rubella outbreak control is essential for eliminating indigenous rubella and preventing CRS and CRI. Strategies for rubella outbreak control include defining target populations for rubella vaccination, ensuring that susceptible persons within the target populations are vaccinated rapidly (or excluded from exposure if a contraindication for vaccination exists), and maintaining rubella and CRS surveillance (*18*). Control measures should be implemented as soon as a case of rubella is identified. Maintaining control measures is essential when pregnant women are possible contacts of patients with rubella. Susceptible pregnant women who are exposed to rubella should be thoroughly evaluated for possible rubella infection.

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Recommendations and Reports

Continuing Education Activity Sponsored by CDC

Control and Prevention of Rubella: Evaluation and Management of Suspected Outbreaks, Rubella in Pregnant Women, and Surveillance for Congenital Rubella Syndrome

EXPIRATION — JULY 13, 2004

You must complete and return the response form electronically or by mail by **July 13, 2004** to receive continuing education credit. If you answer all of the questions, you will receive an award letter for 1.25 hours Continuing Medical Education (CME) credit, 0.1 hour Continuing Education Units (CEUs), or 1.3 hours Continuing Nursing Education (CNE) credit. If you return the form electronically, you will receive educational credit immediately. If you mail the form, you will receive educational credit in approximately 30 days. No fees are charged for participating in this continuing education activity.

INSTRUCTIONS

By Internet

1. Read this *MMWR* (Vol. 50, RR-12), which contains the correct answers to the questions beginning on the next page.
2. Go to the *MMWR* Continuing Education Internet site at <http://www.cdc.gov/mmwr/cme/conted.html>.
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4. Fill out and submit the registration form.
5. Select exam questions. To receive continuing education credit, you must answer all of the questions. Questions with more than one correct answer will instruct you to "Indicate all that apply."
6. Submit your answers no later than **July 13, 2004**.
7. Immediately print your Certificate of Completion for your records.

By Mail

1. Read this *MMWR* (Vol. 50, RR-12), which contains the correct answers to the questions beginning on the next page.
2. Complete all registration information on the response form, including your name, mailing address, phone number, and e-mail address, if available.
3. Indicate whether you are registering for CME, CEU, or CNE credit.
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Continuing Medical Education (CME). CDC is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians. CDC designates this educational activity for a maximum of 1.25 hours in category 1 credit towards the AMA Physician's Recognition Award. Each physician should claim only those hours of credit that he/she actually spent in the educational activity.

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Continuing Nursing Education (CNE). This activity for 1.3 contact hours is provided by CDC, which is accredited as a provider of continuing education in nursing by the American Nurses Credentialing Center's Commission on Accreditation.

Goal and Objectives

This *MMWR* provides recommendations regarding the prevention and control of rubella outbreaks in the United States. These recommendations were prepared by CDC staff members after consultation with state and local public health officials. The goal of this report is to improve the control of rubella in the United States. Upon completion of this continuing education activity, the reader should be able to a) describe characteristics of recent rubella outbreaks, b) list steps recommended for evaluation and management of a suspected rubella outbreak, c) recognize contraindications and precautions to the use of rubella vaccine, and d) identify strategies for the prevention of rubella among women of childbearing age.

To receive continuing education credit, please answer all of the following questions.

1. What is the most common setting for recent rubella outbreaks?

A. Elementary school.
B. Day care.
C. College dormitory.
D. Workplace.
E. Place of worship.

2. Which of the following is acceptable to establish the laboratory diagnosis of rubella virus infection?

A. Positive serologic test for rubella immunoglobulin M (IgM) antibody.
B. Significant rise between acute and convalescent titer of rubella immunoglobulin G (IgG) antibody.
C. Isolation of rubella virus from a clinical specimen.
D. Detection of rubella virus by reverse transcriptase polymerase chain reaction.
E. All of the above are acceptable to establish the laboratory diagnosis of rubella virus infection.

3. What is the most common single defect identified with congenital rubella syndrome?

A. Hearing impairment.
B. Patent ductus arteriosus.
C. Cataract.
D. Mental retardation.
E. Bone defects.

4. Which of the following is not a recommended step for managing a suspected rubella outbreak?

A. Confirm the diagnosis of rubella.
B. Vaccinate all contacts of the person with rubella regardless of previous rubella vaccination history.
C. Initiate enhanced rubella surveillance measures.
D. Conduct outreach in affected communities.
E. Develop a plan for preventing future rubella outbreaks.

5. Which of the following is a valid contraindication to the use of measles-mumps-rubella (MMR) vaccine?

A. Current treatment with antibiotics.
B. Mild asthma.
C. Severe allergic reaction to a previous dose of MMR vaccine.
D. Household contact with a pregnant woman.
E. All of the above are valid contraindications to the use of MMR vaccine.

6. What age group currently accounts for the most reported rubella cases in the United States?

A. Infants aged <12 months.
B. Children aged 1–4 years.
C. Children aged 5–14 years.
D. Adults aged >15 years.
E. No specific age group accounts for the most reported rubella cases in the United States.

7. What is a value of molecular typing of rubella virus?

A. To determine the origin of the virus.
B. To determine the pathogenicity of the virus.
C. To estimate the potential efficacy of rubella vaccine.
D. To determine the susceptibility of the virus to antiviral agents.
E. To identify viruses that could be included in new vaccines.

8. What information should be collected from all persons with rubella?

A. Date of onset of illness.
B. Possible setting of rubella transmission.
C. Results of laboratory testing.
D. Recent travel history.
E. All of the above information should be collected from persons with rubella.

9. Which of the following is not acceptable as evidence of rubella immunity in a woman of childbearing age?

A. Documentation of one dose of MMR vaccine on or after the first birthday.
B. Documentation of two doses of MMR vaccine on or after the first birthday.
C. Positive serologic test for rubella IgG antibody.
D. Birth before 1957.
E. All of the above are acceptable as evidence of rubella immunity in a woman of childbearing age.

10. Indicate your work setting.

A. State/local health department.
B. Other public health setting.
C. Hospital clinic/private practice.
D. Managed care organization.
E. Academic institution.
F. Other.

11. Which best describes your professional activities?

A. Patient care — emergency/urgent care department.
B. Patient care — inpatient.
C. Patient care — primary care clinic or office.
D. Laboratory/pharmacy.
E. Public health.
F. Other.

12. I plan to use these recommendations as the basis for . . . (*Indicate all that apply.*)

A. health education materials.
B. insurance reimbursement policies.
C. local practice guidelines.
D. public policy.
E. other.

13. Each month, to approximately how many persons do you administer rubella vaccine?

A. None
B. 1–5.
C. 6–20.
D. 21–50.
E. 50–100.
F. >100.

14. How much time did you spend reading this report and completing the exam?

A. Less than 1 hour.
B. 1–1.5 hours.
C. 1.5–2 hours.
D. More than 2 hours.

15. After reading this report, I am confident I can describe characteristics of recent rubella outbreaks.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

16. After reading this report, I am confident I can list steps recommended for evaluation and management of a suspected rubella outbreak.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

17. After reading this report, I am confident I can recognize contraindications and precautions to the use of rubella vaccine.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

18. After reading this report, I am confident I can identify strategies for the prevention of rubella among women of childbearing age.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

19. The objectives are relevant to the goal of this report.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

20. Overall, the presentation of the report enhanced my ability to understand the material.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

21. These recommendations will affect my practice.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

22. How did you learn about this continuing education activity?

A. Internet.
B. Advertisement (e.g., fact sheet, *MMWR* cover, newsletter, or journal).
C. Coworker/supervisor.
D. *MMWR* subscription.
E. Other.

23. The availability of continuing education credit was important to my decision to read this report.

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

Correct answers for questions 1–9.

1. D; 2. E; 3. A; 4. B; 5. C; 6. D; 7. A; 8. E; 9. D.

MMWR Response Form for Continuing Education Credit
July 13, 2001/Vol. 50/No. RR-12

Control and Prevention of Rubella: Evaluation and Management of Suspected Outbreaks, Rubella in Pregnant Women, and Surveillance for Congenital Rubella Syndrome

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5. [ ] A [ ] B [ ] C [ ] D [ ] E
6. [ ] A [ ] B [ ] C [ ] D [ ] E
7. [ ] A [ ] B [ ] C [ ] D [ ] E
8. [ ] A [ ] B [ ] C [ ] D [ ] E
9. [ ] A [ ] B [ ] C [ ] D [ ] E
10. [ ] A [ ] B [ ] C [ ] D [ ] E [ ] F
11. [ ] A [ ] B [ ] C [ ] D [ ] E [ ] F
12. [ ] A [ ] B [ ] C [ ] D [ ] E
13. [ ] A [ ] B [ ] C [ ] D [ ] E [ ] F
14. [ ] A [ ] B [ ] C [ ] D
15. [ ] A [ ] B [ ] C [ ] D [ ] E
16. [ ] A [ ] B [ ] C [ ] D [ ] E
17. [ ] A [ ] B [ ] C [ ] D [ ] E
18. [ ] A [ ] B [ ] C [ ] D [ ] E
19. [ ] A [ ] B [ ] C [ ] D [ ] E
20. [ ] A [ ] B [ ] C [ ] D [ ] E
21. [ ] A [ ] B [ ] C [ ] D [ ] E
22. [ ] A [ ] B [ ] C [ ] D [ ] E
23. [ ] A [ ] B [ ] C [ ] D [ ] E

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