Rubella Among Crew Members of Commercial Cruise Ships—Florida, 1997

During April-July 1997, two different commercial cruise lines notified CDC of rubella outbreaks among crew members. In July 1997, CDC initiated an investigation on one cruise ship to determine the extent of and risk factors for rubella infection among crew members and to assess the potential risk for rubella transmission to passengers—particularly rubella-susceptible pregnant women at risk for giving birth to an infant with congenital rubella syndrome (CRS). This report summarizes rubella outbreaks involving two cruise ships and the results of the CDC investigation on one cruise ship, which demonstrate that crew members can serve as a susceptible population for rubella infection and should be vaccinated with measles-mumps-rubella vaccine (MMR) if they are not immune. Although the outbreaks were limited to crew members, cruise ship travel provides an environment conducive to the potential spread of rubella and other infectious diseases among crew and passengers; therefore, women of childbearing age, particularly pregnant women, should be immune to rubella before traveling on cruise ships to reduce the risks for rubella infection and CRS.

Cruise Ship A

On April 7, cruise line A notified CDC about a rash illness in a crew member aboard one of the ships in its fleet. The cruise ship sailed twice a week from Florida to the Bahamas, carrying approximately 900 crew members and 2000 passengers per cruise. During May and June, rash illnesses were reported in six additional crew members; five of the seven cases were confirmed serologically (by immunoglobulin IgM antibodies) as acute rubella infection. A survey of the crew members conducted by the cruise line indicated that a substantial proportion had no documentation of rubella vaccination and that at least 95% were not U.S.-born. Because of evidence of ongoing transmission of rubella among crew members (many of whom were natives of countries without rubella vaccination programs) and the potential for transmission to female crew members and passengers of childbearing age, CDC advised the cruise line to initiate a vaccination campaign with MMR during June. Serologic susceptibility testing was recommended for all crew members ineligible for vaccination, including pregnant women. Cruise line staff and state and local health department personnel vaccinated 865 (96%) of the approximately 900 crew members who had no documented rubella vaccination or immunity. Following the vaccination campaign, one additional rash illness was reported in a crew member and subsequently was serologically confirmed to be consistent with acute rubella infection. This crew member had received MMR less than 2 weeks before the onset of rash.

Cruise Ship B

On July 25, cruise line B notified CDC about a cluster of rash illnesses among crew members of one of its cruise ships sailing between Florida and the Bahamas. The cruise ship sailed daily from Florida with a crew of 385 and carried approximately 8400 passengers per week. CDC initiated an investigation in July to determine the extent of the outbreak and risk factors for rubella infection among crew members and to assess the potential risk for rubella transmission to passengers, particularly rubella-susceptible pregnant women at risk for serious adverse health outcomes (including CRS).

The investigation included review of the ship’s medical logs and interviews and examinations of the 385 crew members. Because approximately 25%-50% of rubella infections are asymptomatic, a serosurvey of rubella IgM and IgG antibodies was conducted among 366 consenting crew members. A confirmed case was defined as IgM serology consistent with rubella infection, or signs and symptoms meeting the clinical case definition for rubella and linked epidemiologically to a laboratory-confirmed case with onset during May 30-August 2. Rubella was confirmed in 16 (4%) crew members; all confirmed cases had IgM serology consistent with rubella infection. Of 16 crew members with IgM-confirmed cases, eight (50%) had no symptoms of infection. An additional 25 (7%) of the 366 crew members surveyed were susceptible to rubella at the time of the serosurvey. The crew interviews indicated that approximately 85% of the crew members were not U.S.-born (representing at least 50 countries), and 75% had negative or unknown rubella vaccination histories. Crew members living aboard the ship were more likely to have confirmed rubella than were crew members living ashore (16 of 288 versus zero of 78; relative risk=9.0 [Woolf’s estimate], P=0.03).

To determine demographic characteristics of passengers on cruise ship B and identify pregnant women who, if susceptible to rubella, could be at risk for giving birth to infants with CRS, a questionnaire was administered to passengers sailing on cruises during August 4-8. All passengers (approximately 6000) received a health alert about the rubella outbreak before boarding the ship; 3643 (61%) passengers completed the questionnaire. Among the respondents, approximately 73% of passengers were U.S.-born, 12% were born in the Bahamas, and 13% were born in other countries. A total of 1213 (33%) of the 3643 respondents were women...
of childbearing age (i.e., 15-44 years); 28 (0.8%) of all respondents were pregnant women, of whom 14 (50%) reported being in the first trimester. Although the rubella immune status of these pregnant passengers was not determined, previous serosurveys in the U.S. population suggest that approximately 10% of women of childbearing age may be susceptible to rubella, and up to 85% of susceptible pregnant women who are infected during their first trimester may give birth to an infant with CRS.4

**Reported by:** H Heshmati, MD, J Moini, MD, C Krugg, Brevard County Health Dept, Merritt Island; M McMillan, C Castro, J Griffiths, Broward County Health Dept, Fort Lauderdale; HT Janowski, MPH, Florida Dept of Health. Vessel Sanitation Program, Special Programs Group, National Center for Environmental Health; Child Vaccine Preventable Disease Br, Epidemiology and Surveillance Div, National Immunization Program; Miami Quarantine Station, Program Operations Br and Surveillance and Epidemiology Br, Div of Quarantine, National Center for Infectious Diseases, CDC.

**CDC Editorial Note:** Although rubella is typically a mild, self-limited disease in adults, infection in pregnant women can result in serious adverse health outcomes for the fetus, including CRS, a group of birth defects including deafness, cataracts, heart defects, and mental retardation. In the United States, approximately 10% of young adults are susceptible to rubella; in other countries, some without routine vaccination policies for rubella, susceptibility rates for rubella range from 4% to 68%.3 During 1994-1996, 12 laboratory-confirmed cases of CRS were reported in the United States.4

Although a definitive quantification of the risk for transmission of rubella among crew members and passengers on the cruise ships could not be ascertained, risk for infection among those crew members of cruise ship B could be estimated. Results of the serosurvey among crew members indicate that at least 41 (11%) of 366 were acutely infected with or susceptible to rubella at the time of the serosurvey. This serosurvey was conducted after recognition of an ongoing outbreak of rash illnesses among crew members, and it is likely that rubella susceptibility rates at the outset of the outbreak would have been higher.

The risk for transmission of infection and an outcome of CRS in pregnant passengers in their first trimester of pregnancy on cruise ship B was difficult to determine because (1) the rubella immune status of these pregnant passengers was unknown and (2) the consequences of rubella infection in susceptible pregnant women (i.e., CRS) may not be evident for several months after the exposure. If pregnant passengers were exposed, and assuming that approximately 10% of these women were susceptible to rubella and 85% of susceptible pregnant women who are infected during their first trimester will give birth to an infant with CRS, one case of CRS could potentially occur each week among passengers sailing during the outbreak.

Minimizing or eliminating the risk for rubella exposure among susceptible pregnant women is important because of the potential for serious adverse health outcomes for the fetus. To interrupt transmission of rubella among crew members and to prevent transmission of infection and CRS among susceptible pregnant women, CDC recommended administration of MMR to all crew members lacking documented immunity to rubella; serologic testing to determine susceptibility to rubella for all crew members ineligible for vaccination, including pregnant women; active surveillance aboard the ship to detect new rubella infections; prospective notification of the potential risk for rubella exposure to all embarking passengers until 30 days after the last confirmed rubella infection; and retrospective notification to all passengers sailing during the period of potential rubella transmission. These recommendations were effective in interrupting rubella transmission among crew members on cruise ship B: no additional rash illnesses were identified after their implementation.

This report of two clusters of rubella infections on commercial cruise ships demonstrates that crew members—many from countries without routine rubella vaccination programs—are potential groups of susceptible persons at risk for rubella infection. To prevent future rubella outbreaks among such persons, CDC recommends that cruise lines administer MMR to all crew members without documented immunity to rubella.

Although reported rubella cases in these two outbreaks were limited to crew members, cruise ship travel provides a semi-closed environment for crew and passenger interactions, conducive to the potential spread of rubella and many other infectious diseases among crew and passengers. To prevent transmission of rubella infection and subsequent CRS, women of childbearing age, particularly pregnant women, should be immune to rubella before cruise ship excursions or international travel.

The outbreaks described in this report illustrate the potential for transmission of infectious disease among persons traveling across international borders, including aboard commercial cruise ships. Previous infectious disease outbreaks reported among crew members and passengers have included diarrheal diseases and other vaccine-preventable diseases such as influenza.5 Approximately 4 million persons travel aboard North American cruise ships each year (CDC, unpublished data, 1998). Ensuring routinely recommended adult vaccinations for all crew members will substantially decrease the potential for future outbreaks of vaccine-preventable illnesses aboard cruise ships.

**REFERENCES**