Coccidioidomycosis in Workers at an Archeologic Site—Dinosaur National Monument, Utah, June-July 2001

**MMWR. 2001;50:1005-1008**

1 figure omitted

**Coccidioidomycosis is a fungal infection caused by inhalation of airborne Coccidioides immitis spores that are present in the arid soil of the southwestern United States, California, and parts of Central and South America. Infection with C. immitis previously has not been diagnosed in patients outside these areas, except in travelers returning from areas where the disease is endemic.** This report describes an outbreak of coccidioidomycosis in workers at an archeologic site in northeastern Utah during June-July, 2001, and represents the first identification of coccidioidomycosis in northern Utah. Health-care providers should consider coccidioidomycosis in the differential diagnosis for patients with compatible illness who reside in or recently have traveled to this area. Interventions to minimize soil disturbance and dust inhalation can reduce the risk for coccidioidomycosis.

Dinosaur National Monument (DNM) encompasses 320 square miles in northeastern Utah and western Colorado; 397,800 persons visited DNM in 2000. On June 18, 2001, under the direction of National Park Service (NPS) archeologists, six student volunteers and two leaders began work at an archeologic site in DNM. Work included laying stone steps, building a retaining wall, and sifting dirt for artifacts. Peak dust exposure occurred on June 19, the day most sifting occurred. Workers did not wear protective facemasks. During June 29-July 3, all eight team members and two NPS archeologists who had worked at the site sought medical care at a local hospital emergency department for respiratory and systemic symptoms. All 10 persons had diffuse pulmonary infiltrates on chest radiographs; eight were hospitalized with pneumonia of unknown etiology. Pending investigation, NPS closed the work site to all visitors and staff, and the TriCounty Health Department alerted the public. On July 2, the TriCounty Health Department, the Utah Department of Health, and CDC initiated an investigation to identify the risk factors, cause, and extent of the outbreak.

During July 2-4, a total of 18 persons (the eight team members and 10 archeologists) with potential exposure to dust at the work site in June were interviewed using a standardized questionnaire to determine symptoms and previous activities. Hospital records were reviewed to ascertain clinical information. A case was defined as an illness with onset of at least two selected symptoms (i.e., self-reported fever, difficulty breathing, and cough) after June 18 in a person working at DNM. Illness in 10 persons, including all eight team members and two NPS archeologists, met the case definition. Median age was 17 years (range: 16-29 years). Illness onset occurred during June 28-July 1. The most common symptoms included difficulty breathing (ten), fever (ten), cough (nine), fatigue (eight), shortness of breath (seven), myalgia (six), and generalized skin rash (six). All 10 persons present at the work site on June 19 had illness that met the case definition, compared with none of the eight who did not work that day (Fisher exact p-value = 0.00002). One ill person had visited the work site only on June 19 and had illness onset on June 29.

Results of blood cultures from the hospitalized persons were negative for bacterial pathogens. Initial serologic tests were negative for antibodies to Francisella tularensis, Yersinia pestis, Mycoplasma species, Histoplasma capsulatum, and C. immitis. On further analysis, using serum specimens concentrated 3-5 fold in an assay that detects IgM antibodies (immunodiffusion tube precipitin), nine of the 10 acute serum specimens from patients contained IgM antibodies to C. immitis, confirming the diagnosis of acute coccidioidomycosis. All hospitalized patients were treated with fluconazole. The average length of hospital stay was 1.5 days.

Because approximately 60% of infections with C. immitis are asymptomatic, a serosurvey of park employees was conducted during August 15-17 to identify other infected persons and to guide prevention and control measures. Of the 40 park employees participating in the serosurvey, three (7.5%) reported "flu-like illness" since June. None of the 40 had detectable IgM or IgG antibodies to C. immitis. These results suggest that infection with C. immitis during the preceding 12 weeks was unlikely.

Investigation of the work site on July 3 revealed a desert environment with the ground covered with bedonite, a fine, alkaline soil that can provide a conducive environment for C. immitis spores. NPS is working with the U.S. Geological Survey to conduct mycologic studies of the soil (M. Bultman, personal communication, October 2001).

On August 24, the state and local health departments jointly recommended that employees minimize soil disturbance and dust inhalation (e.g., watering down the soil and wearing National Institute for Occupational Safety and Health [NIOSH]-approved N95 respirators) at the work site to reduce their risk for C. immitis infection. During September 24-27, four NPS employees completed work on the retaining wall and steps. Subsequently, one de-
developed respiratory illness consistent with coccidioidomycosis and laboratory evidence of acute infection (IgM and rising titer of IgG to C. immitis).

The site reopened on September 28. NPS guidelines advise DNM visitors to stay on maintained trails to avoid raising dust or stepping on native soil. Visitors’ risk for infection with C. immitis should be minimal because their exposure to inhaled dust is substantially lower than that experienced by the persons in this outbreak. However, additional measures are being considered to minimize risk for visitors, including warnings to avoid the site when wind conditions are conducive to dust exposure. Surveillance is ongoing at area hospitals.

Reported by: D Mardo, RA Christensen, N Nelson, MD; S Hust, MPHSA, Ashley Valley Medical Center; R Hyun, MD; J Shaffer, MA, TriCounty Health Dept, Vernall; AV Gundlapalli, MD, Univ of Utah School of Medicine, Salt Lake City; C Barton, G Dowdle, MSPH, Salt Lake County; J Hensor, MD, State Epidemiologist, Utah Dept of Health. D Panebaker, National Park Service, US Dept of the Interior. Div of Vector-borne Infectious Diseases; Mycotic Diseases Br, Div of Bacterial and Mycotic Diseases, National Center for Infectious Diseases; Epidemiology Program Office; and EIS officers, CDC.

CDC Editorial Note: DNM is located approximately 200 miles north of the area of Utah where C. immitis is endemic. Soil disturbances can aerosolize C. immitis spores (arthroconidia) and result in coccidioidomycosis outbreaks. Other ground-disturbing activities, such as construction or archeology digs, may increase the risk for infection. A similar point-source outbreak of coccidioidomycosis occurred in 1970 among archeology students in northern California where C. immitis was not known to be endemic. In both of these outbreaks, a high attack rate of symptomatic infection was reported.

Symptoms of acute coccidioidomycosis include fever, headache, rash, muscle aches, dry cough, weight loss, and malaise. Most infections are asymptomatic or self-limited and resolve without antimicrobial treatment in patients with healthy immune systems. In rare instances, severe lung disease or disseminated infection can develop in patients; susceptibility is higher in immunocompromised persons, pregnant women, and persons of African or Asian descent.

Because infection with C. immitis results in long-term immunity, the coccidioidin or spherulin skin test, which detects T-cell mediated delayed-type hypersensitivity to C. immitis, is the best method to screen for past infection. However, the coccidioidin skin test is not available in the United States. Therefore, a serosurvey was used to assess for subclinical cases of infection in this outbreak. In previous studies of asymptomatic persons who had positive skin tests, 7% had positive serologies; the time of exposure in those persons was unknown. The sensitivity of the serologic test is low for remote past infection and unknown for recent asymptomatic infection. Therefore, this investigation was unable to establish the prevalence of previous infection among tested NPS employees.

In settings where coccidioidomycosis outbreaks have occurred, measures to minimize soil disturbance and dust inhalation reduce the risk for inhalation of C. immitis spores. The most recent case indicates an ongoing risk for infection at the site associated with this outbreak and the importance of adherence to recommendations for respiratory protection (e.g., NIOSH-approved N95 respirators that are properly fitted and consistently worn) when dust exposure is unavoidable.

The outbreak in this location indicates that areas where C. immitis is endemic may extend farther north than previously documented. Surveillance should be continued in these areas. In addition, health-care providers should be alert for coccidioidomycosis cases in persons who reside in or have traveled to these areas and who may have been exposed to dust from disturbed soil.

REFERENCES
A cohort was identified of 104,192 children vaccinated with Var from HMO A and 10,482 from HMO B. The median age of children receiving Var was 15 months (range: 12-71 months). The median follow-up time after Var was administered was 20 months (range: 1 day-4.5 years). The number of children aged ≥12 months receiving other vaccines simultaneously with Var, receiving Var before 30 days following other vaccines, and receiving Var ≥30 days before or after other vaccines also were identified. The median age and age range were not available for vaccines other than Var.

The simultaneous administration with Var of the vaccines studied did not increase the risk for breakthrough disease. Receipt of Var <30 days following MMR was associated with a 2.5-fold increase in the incidence of breakthrough disease (95% confidence interval [CI]=1.3-4.9). Receipt of Var <30 days following any of the other vaccines did not increase the risk for breakthrough disease.

Reported by: J Mullooly, PhD, Northwest Kaiser Permanente, Portland, Oregon. S Black, MD, Northern California Kaiser Permanente, Oakland and San Francisco, California. Child Vaccine Preventable Disease Branch and Vaccine Safety and Development Activity, Epidemiology and Surveillance Div, National Immunization Program; and an EIS Officer, CDC.

CDC Editorial Note: No adverse effects have been reported of simultaneous administration of DTP, Hib, MMR, and OPV on the immunogenicity of Var,3-6 and the absence of increased risk for breakthrough varicella among children receiving MMR, DTP, Hib, OPV or HepB simultaneously with Var confirms these findings. Recommendations that caution against the use of Var and MMR within 30 days of each other1 are based on the reported reduction in responsiveness to smallpox vaccine following measles vaccine.7 Findings in this report indicate an increased risk for breakthrough disease in children who received Var <30 days after MMR.

No evidence was found that simultaneous administration of MMR, DTP, Hib, OPV, IPV, or HepB and Var increases the risk for breakthrough disease. To minimize the number of visits needed for immunization, Var should be administered simultaneously with these vaccines or should follow administration of MMR by ≥30 days.

REFERENCES
6. Shinefield HR, Black SB, Morozumi P. Safety and immunogenicity of concomitant separate administration of MMR II, Tetramune (Wyeth Lederle DTP & HibOC) and Varivax (Okai/默克法尔维拉尔疫苗) vs concomitant injections of MMR II, Tetramune with BVarivax given six weeks later. Washington, DC: Society for Pediatric Research; 1996.