MMWR Weekly
January 27, 2006 / 55(03);71-74

Surveillance for Early Detection of Disease Outbreaks at an Outdoor Mass Gathering --- Virginia, 2005

Implementing public health surveillance at mass gatherings might help detect outbreaks or possible acts of biologic terrorism and enable prompt public health intervention. In July 2005, a daily syndromic sentinel surveillance system was implemented to monitor disease and injury among approximately 43,000 youths and adults attending a 10-day camping event held every 4 years by a national youth organization. Camp activities began on July 25, 2005, and included events such as mountain boarding, rappelling, and whittling. This report describes public health surveillance and response activities during the 10-day event and presents recommendations for health surveillance at large outdoor events. Public health surveillance should be implemented at mass gatherings to facilitate rapid detection of outbreaks and other health-related events and enable public health teams to respond with timely control measures.

Campers, predominantly young males from throughout the United States and other countries, began to arrive at the camp on July 24, 2005. The camp was held at a publicly owned site covering an area of approximately 7 square miles in Virginia. The camp was divided into 20 subcamps, each containing 31--90 groups of approximately 40 campers each. Although meals were prepared in small groups within subcamps, water was shared across subcamps for drinking and hand-hygiene purposes. Clusters of outdoor pit latrines and shower facilities were scattered throughout the subcamps. Small clinics staffed by medical personnel served each subcamp, with five additional medical clinics available to campers and guests throughout the encampment. The Virginia Department of Health and the sponsoring youth organization had requested a federal public health team to help establish and maintain public health surveillance and advise on outbreak prevention and control.

As buses arrived during the first 2 days of the event, medical and public health personnel screened persons on each incoming bus, using a standard interview form that included questions about presence of the following symptoms: vomiting, diarrhea, rash, fever, pink or red eye, and cough. If any group of campers on a single bus had at least three persons with symptoms commonly associated with communicable disease during the preceding 48 hours, the entire group was referred for in-depth screening by the public health support team. Ill campers were interviewed about the nature and timing of symptoms, travel history, and source of food and beverages consumed during the preceding 72 hours.

In addition to these initial screenings, a daily syndromic sentinel surveillance system was used for rapid detection of communicable disease outbreaks to enable prompt public health intervention

Medical staff at each of the 25 clinics recorded each patient's chief complaint and disposition in a log specific to that clinic. Diagnoses were categorized into one of the following 10 syndromic illness categories: gastrointestinal (GI); respiratory; infectious disease; bite (tick); bite/sting (other); heat (skin/sunburn); heat (exhaustion/stroke); injury (laceration/abrasion/puncture); cardiovascular; and other. Rate estimates for each illness and injury category were calculated by dividing the total number from each specific category by the total population. These reports were reviewed routinely and used as a guide for active surveillance and intervention.

Gastroenteritis

Initial screening on July 25 identified two groups (A and B) of campers with symptoms of gastroenteritis. Group A initially had eight (20%) of 40 members with vomiting and diarrhea when screened. By the next morning, three additional campers in group A had become ill with similar symptoms. Although only six (8%) of 80 campers in group B had symptoms on arrival day, 22 cases of GI illness were reported in group B campers 60 hours before arrival. All illnesses in groups A and B were characterized by acute onset of malaise, nausea, vomiting, and diarrhea. Symptoms typically lasted 24--48 hours. Review of cases by date of onset suggested an infectious illness that had an incubation period of approximately 24--48 hours. Attack rates were 40% (16 of 40) for group A and 48% (38 of 80) for group B. The syndromic surveillance system alerted staff within 24 hours to a third group (C) with GI illness; 15 (38%) of 40 campers from group C were ill during the entire event. A call from a physician in another camp led the team to investigate a fourth group (D) in which eight (20%) of 40 persons had symptoms similar to those of groups A and B (Figure). Overall incidence of GI disease for the entire camp throughout the event was 22.2 cases per 1,000 persons. Investigators were unable to determine whether campers from groups C and D had contact with groups A and B and were potentially exposed to previously identified GI illness clusters.

Six stool specimens (two each from groups A and D and one each from groups B and C) were tested during the event at the Virginia Division of Consolidated Laboratory Services, and four (66.7%) (two from group A and one each from groups B and D) were determined by reverse-transcription polymerase chain reaction to be positive for norovirus. The four positive specimens were subjected to nucleic acid sequencing to compare the viral strain types to each other and to those in a database of norovirus prototype sequences obtained from CDC. Viral sequences obtained from groups A and C were genetically similar and differed by only a single nucleotide. The group B isolate was genetically distinct from that of groups A and C; viral sequences were not able to be obtained from Group D.

Control measures implemented for GI infection clusters identified during arrival screening included isolation for 48 hours and use of separate toilet, shower, and hand-washing facilities. Persons who were symptomatic were restricted from preparing and handling food for the remainder of their stay at the encampment. Hand washing was reinforced to campers on a daily basis. In accord with public health team recommendations, any persons with new symptomatic cases from GI infection clusters were isolated in the medical clinic for up to 48 hours after resolution of symptoms.

Heat-Related Events

During July 24--August 2, a total of 14,857 injury and illness events were logged among campers, visitors, and staff at medical clinics. Of these, 3,486 (23.5%) were for heat-related conditions; cases were designated by the surveillance system in one of two illness categories: "heat (skin/sunburn)" or "heat (exhaustion/stroke)." A total of 1,624 persons were treated specifically for heat-related exhaustion/stroke, with a mean daily rate of 3.7 cases per 1,000 persons; 194 persons were transported to the onsite hospital for treatment. The daily rate of heat-related exhaustion/stroke and

heat-index* measurements ranged from 0.4 to 11.5 cases per 1,000 persons and 86°F (30°C) to 121°F (49.4°C), respectively. The highest rate of heat-related exhaustion/stroke, 11.5 cases per 1,000 persons, was observed on July 27. On this day, the heat index was 121°F (49.4°C), the highest observed during the entire camping event, and attendees were exposed to other stressful conditions, such as hiking and standing in direct sunlight in a stadium for several hours awaiting a special event, without adequate water or shade structures.

The special event was rescheduled for July 31; additional shade structures and portable water reservoirs were provided and air-conditioned buses were used as cooling stations. Although the heat-index on July 31 was 90°F (32.2°C), participants at the gathering experienced one of the lowest rates of heat-related exhaustion/stroke during the 10-day event, with approximately 0.6 cases per 1,000 persons.

Other Illness and Injury Events

A total of 3,959 (26.7%) injury/illness events were classified as "other" and included such health problems as blisters, nosebleeds, and dental problems. Injuries (including lacerations and abrasions) were common during the surveillance period, accounting for 2,795 (18.8%) visits. Other reasons for seeking medical care included 1,016 (6.8%) visits for respiratory problems, 453 (3.0%) for ticks, 1,377 (9.3%) for bites/stings, 417 (2.8%) for rashes, and 96 (0.6%) for cardiovascular problems (e.g., high blood pressure or chest pain). Five adult deaths occurred during the 8-day event, one caused by myocardial infarction and four caused by electrocution.

Reported by: *M Coletta, MPH, L Dewey, MPH, M White-Russell, T Powell, MPH, Virginia Dept of Health. D Toney, PhD, Virginia Div of Consolidated Laboratory Svcs. J Cheek, MD, D Wong, MD, P Young, MPH, Indian Health Svc. E Melius, MN, MPH, S Sandhu, PhD, EIS officers, CDC.*

Editorial Note:

The findings in this report underscore the utility of public health screening and surveillance at mass gatherings and the importance of implementing prevention and control measures on the basis of surveillance data. Syndromic surveillance, in conjunction with active visits with subcamp medical staff to reinforce surveillance importance and inquire about illness, alerted the epidemiology team to the GI outbreak in group C and heat-related events and enabled the public health team to monitor other injury and illness trends. By following up on illness and injury clusters identified daily by syndromic surveillance throughout the event, the public health team was able to implement control measures for the GI illness outbreak and recommend measures for preventing heat-related illness.

Initial screening detected two of four GI illness outbreaks; syndromic surveillance, in conjunction with active visits to subcamp medical personnel, alerted the team to two additional GI illness outbreaks within 24 to 36 hours. Similar findings (i.e., three laboratory-confirmed norovirus outbreaks) were detected through initial screening at a camp sponsored by the same organization in 2001; however, no additional GI illness outbreaks were identified by the syndromic surveillance system implemented at that camp (*1*). Syndromic surveillance at a smaller outdoor gathering of a different group in Pennsylvania in 1999 identified diarrheal illnesses, musculoskeletal injuries, and bites as the most common events for which participants sought care (*2*). An outbreak of shigellosis at a mass gathering in 1987 subsequently spread to the general public after the group had dispersed (*3*); that example highlights the importance not only of identifying outbreaks quickly at mass gatherings, but also of implementing control measures to prevent further transmission of illness to the community after the event.

Although no deaths associated with heat-related illness occurred during this 10-day mass gathering, 1,624 heat-related exhaustion cases were observed among approximately 43,000 attendees. During 1979--2002, a total of 8,966 heat-related deaths† were documented in the United States (*4*). The annual heat-related death rate averages from 230 to 1,700 deaths per year, depending on weather conditions (*5*). Exposure to excessive heat also contributes to a range of heat-related illnesses, including heat cramps, and to more serious consequences, such as heat exhaustion and heat stroke (*6*). Risk factors for heat-related mortality and morbidity include age, socioeconomic status, urban living, and not practicing preventive behaviors (*7*). Heat-related illnesses are an important concern during prolonged exposure to heat and can be reduced at crowded outdoor events by anticipating changing environmental conditions, recognizing how persons might be at risk, and providing adequate shade structures, water, and cooling stations.

The findings in this report are subject to at least three limitations. First, misclassification of illness and injury might have occurred on the epidemiology summary form because the categories were not clearly defined or mutually exclusive. Furthermore, because different persons completed the forms each night, recording might not have been consistent. Some providers also might have reported multiple diagnoses. Second, shortage of staff time to complete the reporting form resulted in some subcamps failing to report every night; thus, data collection was incomplete. Finally, potential underreporting of heat-related illness occurred at the July 27 event when the number of ill campers overwhelmed the system; many cases were not recorded.

Because initial screening for this event was a critical component in detecting outbreaks, similar screening of participants upon arrival should be considered for comparable sites when feasible, along with syndromic surveillance. The syndromic surveillance system used for this gathering could be improved by implementation of an electronic medical record system, which would allow for immediate and real-time disease reporting and would eliminate the need for additional staff time to complete forms. In addition, clear case definitions for syndromes should improve surveillance accuracy.

Public health planning for multi-day, outdoor mass gatherings should involve the event planning staff, local and state health departments, and other agencies responsible for public health and safety. Plans should include 1) prescreening to detect disease and illness of persons before they enter the event site; 2) implementing a syndromic surveillance system with clear case definitions for injury/illness syndromes, combined with education for system users; 3) assessing the usefulness of an electronic medical record system, which would allow for immediate and real-time disease reporting; 4) estimating local response capacity for laboratory diagnosis and emergency medical treatment; and 5) preparing triage and evacuation systems.

References

1. CDC. Norwalk-like virus--associated gastroenteritis in a large, high-density encampment---Virginia, July 2001. MMWR 2002;51:661--3.
2. CDC. Public health aspects of the Rainbow Family of Living Light annual gathering---Allegheny National Forest, Pennsylvania, 1999. MMWR 2000;49:324.
3. Wharton M, Spiegel RA, Horan JM, et al. A large outbreak of antibiotic-resistant shigellosis at a mass gathering. J Infect Dis 1990;162:1324--8.
4. CDC. About extreme heat. Atlanta, GA: US Department of Health and Human Services, CDC; 2004. Available at http://www.bt.cdc.gov/disasters/extremeheat/about.asp.
5. CDC. Heat-related illnesses and deaths: United States, 1994--1995. MMWR 1995;44:465--8.
6. CDC. Heat-related deaths---Dallas, Wichita, and Cooke counties, Texas, and United States,

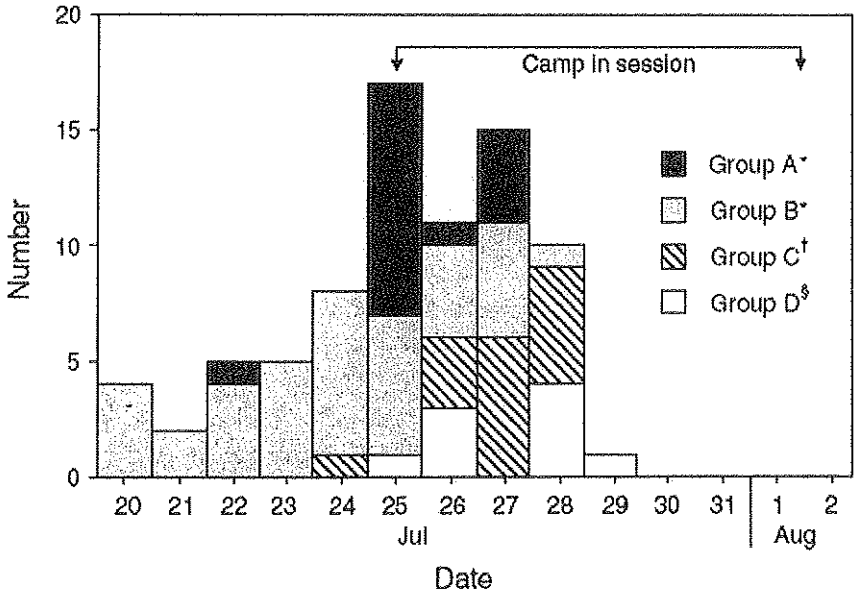
1996. MMWR 1997;46:528--31.
7. McGeehin MA, Mirabelli M. The potential impacts of climate variability and change on temperature-related morbidity and mortality in the United States. Environ Health Perspect 2001;109(Suppl 2):185--9.

* Heat index was calculated using the National Oceanic and Atmospheric Heat Index Calculation Table, which combines air temperature and relative humidity.

† Underlying cause of death during 1979--1998 is classified according to the *International Classification of Diseases, Ninth Revision* (ICD-9). Excessive heat has three categories: E900.0 (due to weather conditions), E900.1 (of man-made origins), and E900.9 (of unspecified origin). The data for 1999--2002 are from ICD-10; code X30 (exposure to excessive natural heat [deaths]) was added to the 1979--1998 ICD-9 code E900.0 (excessive heat due to weather conditions [deaths]).

Figure

FIGURE. Number of reported cases of gastrointestinal illness among attendees of a mass outdoor gathering, by group of campers and date of onset — Virginia, July 20–August 2, 2005



* Detected by initial screening.
† Detected by syndromic surveillance.
§ Detected by active surveillance.

Return to top.

HTML document, but are referred to the electronic PDF version and/or the original *MMWR* paper copy for the official text, figures, and tables. An original paper copy of this issue can be obtained from the Superintendent of Documents, U.S. Government Printing Office (GPO), Washington, DC 20402-9371; telephone: (202) 512-1800. Contact GPO for current prices.

**Questions or messages regarding errors in formatting should be addressed to mmwrq@cdc.gov.

Date last reviewed: 1/26/2006

SAFER · HEALTHIER · PEOPLE™
Morbidity and Mortality Weekly Report
Centers for Disease Control and Prevention
1600 Clifton Rd, MailStop E-90, Atlanta, GA
30333, U.S.A