Heat-Related Deaths—Four States, July-August 2001, and United States, 1979-1999

Each year in the United States, approximately 400 deaths are attributed to excessive natural heat; these deaths are preventable. This report describes heat-related deaths in Missouri, New Mexico, Oklahoma, and Texas when elevated temperatures were recorded for several consecutive days during July-August 2001; summarizes heat-related deaths in the United States during 1979-1999; and presents risk factors and preventive measures associated with heat-related illness and death, especially in susceptible populations.

In late July 2001, the National Oceanographic and Atmospheric Association (NOAA) reported temperatures averaging 5°F (−15°C)–10°F (−12°C) above normal in the southern plains states. The intense heat and humidity prompted NOAA’s National Weather Service to issue heat advisories in Missouri, New Mexico, Oklahoma, and Texas (personal communication 2002). During July-August 2001, a total of 95 deaths was attributed to excessive natural heat in the affected states. Provisional mortality statistics were obtained from the vital statistics section of each state, and information about underlying cause of death, age, sex, date of death, and contributing causes were provided. Peak mortality occurred during the reported 8-day heat advisory period. Six (6%) deaths occurred among children aged ≤4 years and 42 (41%) among persons aged ≥75 years; 69 (73%) deaths occurred among males.

Case Reports

Case 1. In Oklahoma in mid-July 2001, a man aged 29 years was found disoriented and wandering in a commercial parking lot. He apparently had fallen and had abrasions on his knees and a broken tooth. In the emergency department, he was semiconscious but combative. His rectal temperature increased from 105.4°F (40.7°C) to 107.8°F (42.1°C) in <1 hour. Despite medical treatment for hyperthermia, he was pronounced dead 22 hours after being found. Laboratory tests at autopsy were positive for cocaine and alcohol. The medical examiner attributed the cause of death to heat-related illness.

Case 2. In Oklahoma in mid-July 2001, police were called to check on a man aged 62 years with a history of alcoholism, heavy smoking, and poor diet who had not been seen for 7 days. The man was found dead by the police in his home, which was very hot; an ambient temperature was not recorded. A fan and air-conditioning unit in the home were in working order but turned off. Postmortem blood alcohol level was 0.07%. Following an autopsy, the death was attributed to hyperthermia.

Case 3. In Texas in late July 2001, a boy aged 2 years was found in a motor vehicle with the windows rolled up for an undetermined length of time. The boy had locked himself in the car and could not get out. The temperature inside the car was not measured, nor was the outside temperature recorded; however, the high temperatures in central Texas during this time ranged from the mid-to-high 90s. The boy arrived at the hospital with an oral temperature of 102°F (39°C) and died 2 days later. The death was attributed to heatstroke.

Case 4. In a border town in Chihuahua State, Mexico, in August 2001, a man aged 21 years was found collapsed and incoherent on the street. A witness reported that he had complained about abdominal pain and vomiting. He arrived at an emergency department in New Mexico 3 hours after he was found. His rectal temperature was 105.7°F (40.9°C). The patient had laboratory evidence of rhabdomyolysis, severe dehydration, and renal failure. Blood alcohol level and a screen for drugs were negative. He died 3 hours after arrival at the hospital. Cause of death was attributed to hyperthermia due to environmental heat exposure. High temperature at the border that day was 90°F (32°C).

United States

During 1979-1999, a total of 8,015 deaths in the United States was associated with excessive heat exposure, of which 3,829 (48%) were “due to weather conditions,” 377 (5%) were “of man-made origins” (i.e., heat generated in vehicles, kitchens, boiler rooms, furnace rooms, and factories), and 3,809 (48%) were “of unspecified origin.” 182 deaths per year (range: 54-651) were associated with excessive heat due to weather conditions. Of the 3,764 (98%) deaths specified as due to weather conditions with a reported age, 142 (4%) occurred among children aged ≤4 years, and 1,068 (28%) occurred among persons aged ≥75 years.

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CDC Editorial Note: The cases summarized in this report demonstrate risk factors for heat-related illness. Heat-related illnesses include sunburn, heat cramps, heat rash, heat exhaustion, and heatstroke. Of these, the two most serious types of heat-related illness are heat exhaustion and heatstroke, both of which can result in death. Symptoms of...
heat exhaustion include heavy sweating, muscle cramps, fatigue, weakness, paleness, cold or clammy skin, dizziness, headache, nausea or vomiting, and fainting. Untreated heat exhaustion can progress to heatstroke. Even with prompt medical care, 15% of heatstroke cases are fatal.

Symptoms of heatstroke include a high body temperature (oral temperature of ≥103°F [≥39.4°C] or a rectal temperature of 106°F [41.1°C]); red, hot, dry skin and no sweating; rapid pulse; throbbing headache; dizziness; nausea; confusion; disorientation; delirium; and coma. Heatstroke can occur in the absence of physical exertion. Infants, elderly persons, socially isolated persons, bedridden persons, and persons with certain mental and chronic illnesses are at highest risk. The elderly, especially those aged ≥80 years, are susceptible to heat-related illness because they are less able to adjust to physiologic changes (e.g., vasodilation) that occur with exposure to excessive heat and are more likely to be taking medication for chronic illness (e.g., tranquilizers and anticholinergics) that increase the risk for heat-related illness. Infants also are sensitive to heat. Conditions such as mild fever can progress quickly to heatstroke if heat stress occurs. Parents and other caregivers should provide adequate hydration during summer months and refrain from dressing children too warmly. Adults also should keep well hydrated during summer months.

Heatstroke also can occur in young, healthy persons who are exercising, because physical exertion during hot weather increases the likelihood of fainting and cramps caused by increased blood flow to the extremities. Onset of heatstroke can be rapid and is considered a medical emergency.

The findings in this report are subject to at least three limitations. First, information on decedents is provided by surrogates, who might not accurately describe characteristics or behavior of the decedents. Second, heat-related deaths due to weather conditions or exposure to excessive natural heat might represent only a portion of actual heat-related deaths. These deaths often are a diagnosis of exclusion and can be misclassified as a stroke or heart attack. Deaths attributed to cardiovascular and respiratory disease increase following heat waves. In addition, jurisdictions might use different definitions of heat-related death. Finally, ICD-10 coding was introduced in 1999 and might not be comparable with previous data for 1979-1998.

To reduce morbidity and mortality from heat-related illness, many cities have developed emergency response plans. Local officials use meteorologic information and assess population characteristics to implement prevention strategies. Spending time in an air-conditioned area is the strongest factor in preventing heat-related deaths. The use of fans does not appear to be protective during periods of high heat and humidity. If exposure to heat cannot be avoided, prevention measures should include reducing or eliminating strenuous activities or rescheduling them for cooler parts of the day; drinking water or nonalcoholic fluids frequently; taking cool showers frequently; wearing lightweight, light-colored, loose-fitting clothing; and avoiding direct sunshine.

Public health messages disseminated to all age groups can make the public aware of the signs and symptoms of heat-related illness. Prevention messages delivered as early as possible in the media can prevent heat-related illness, injury, and death. Because many heat-related illnesses and deaths occur among the elderly population, older persons should be encouraged to take advantage of air-conditioned environments (e.g., shopping malls, senior centers, and public libraries) for part of the day. Parents and other caregivers should be educated about the heat sensitivity of children aged <5 years.

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Outbreak of Multidrug-Resistant Salmonella Newport—United States, January-April 2002

During January-April 2002, Salmonella serotype Newport was isolated from 47 persons in five states: New York (34 cases), Michigan (five), Pennsylvania (nine), and New Jersey (one). The Multicenter Outbreak Study Group of the Foodborne Diseases Active Surveillance Network and the Salmonella Reference Laboratory, Centers for Disease Control and Prevention, conducted additional investigations at the state and national levels to establish case definitions, investigate the outbreak, and determine the source of illness. The outbreak was caused by Salmonella serotype Newport that was resistant to multiple antimicrobial agents, including ampicillin, chloramphenicol, streptomycin, tetracycline, trimethoprim-sulfamethoxazole, streptomycin, and nalidixic acid (minimum inhibitory concentrations of ≥0.125 μg/mL against all drugs tested except nalidixic acid). The outbreak was epidemiologically linked to consumption of precooked, ready-to-eat breakfast items produced by a single manufacturer. The outbreak was linked to nine outbreaks in 2002 that occurred in the United States and were epidemiologically similar

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Salmonella Newport Infections—United States—Vol 288, No. 8

CDC Editorial Note: An estimated 1.4 million cases of Salmonellosis occur annually in the United States.1 S. Newport is the third most common Salmonella serotype in the United States. During 1997–2001, the number of laboratory-confirmed S. Newport infections reported to CDC increased from 1,584 (5%) of 34,608 reported Salmonella infections to 3,152 (10%) of 31,607 (CDC, unpublished data, 2002). The increasing number of S. Newport infections in the United States appears to be associated with the emergence and rapid dissemination of multidrug-resistant strains of S. Newport.

Since 1996, the National Antimicrobial Resistance Monitoring System (NARMS) for Enteric Bacteria has identified an increasing number of S. Newport isolates that are resistant to at least nine of 17 antimicrobial agents tested: amoxicillin/clavulanate, ampicillin, cefoxitin, cefotiofur, cephalothin, chloramphenicol, streptomycin, sulfathmethoxazole, and tetracycline. In addition, these isolates exhibit decreased susceptibility (minimal inhibitory concentrations [MIC] ≥16mg/ml) or resistance (MIC ≥64mg/ml) to ceftriaxone, thereby complicating empiric therapy for serious Salmonella infections. Clinicians should be informed of the emergence of these S. Newport strains, and persons should refrain from eating undercooked ground beef and wash their hands after handling raw ground beef.

The outbreak was identified on February 11, when a county health department notified NYSDOH of seven cases of S. Newport infection. Pulsed-field gel electrophoresis (PFGE) testing by the NYSDOH laboratory revealed that six isolates had an indistinguishable pattern, and one isolate had a single band difference. NYSDOH defined a case as isolation of S. Newport with a PFGE pattern that was indistinguishable or one band different from the outbreak pattern. Additional cases were reported from Connecticut, Michigan, Ohio, and Pennsylvania through the National Molecular Subtyping Network for Foodborne Disease Surveillance (PulseNet).

A total of 47 cases from the five states was identified. The median age of infected persons was 45 years (range: 2-81 years); 33 (70%) were females. Symptoms occurred during January 1–April 4, with 33 (73%) occurring during February 1-15. Of the 47 patients, 46 were interviewed. The median duration of illness was 9 days (range: 3-60 days). Predominant symptoms included diarrhea (100%), abdominal pain (91%), fever (78%), blood-tinted stools (52%), and vomiting (48%). Six (13%) patients reported other symptomatic household members. A total of 33 (72%) patients received antimicrobial agents, and 17 (37%) were hospitalized. One patient from New York with leukemia developed sepsis and died; S. Newport was identified in both blood and stool cultures from this patient. A total of 44 isolates had an indistinguishable PFGE pattern after analysis with two enzymes (XbaI and AvrII); three isolates differed by one band.

To identify exposures associated with illness, NYSDOH and CDC compared 36 patients (28 from New York, four from Michigan, and four from Pennsylvania) with 85 controls, who were interviewed through random-digit-dialing in case-patients’ home area codes and frequency-matched by age group. A multivariate logistic regression analysis indicated that 22 (67%) of 33 case-patients had eaten ground beef during the 3 days before illness onset compared with 31 (53%) of 58 controls (odds ratio [OR] = 2.3; 95% confidence interval [CI] = 0.9-5.7). Case-patients and controls were asked about eating raw or undercooked ground beef during the 3 days before illness onset. Of the 26 case-patients who answered definitively, 12 (46%) had eaten raw or undercooked ground beef compared with one (1%) of 80 controls (OR = 50.9; 95% CI = 5.3-489.0). A total of 11 patients recalled the type of ground beef eaten; seven (64%) had eaten lean or extra-lean ground beef. The U.S. Department of Agriculture (USDA) Food Safety and Inspection Service (FSIS) was notified after this investigation implicated ground beef as a potential vehicle for exposure.

One New York patient had a left-over, frozen, uncooked meatloaf prepared with the same package of ground beef that was used to prepare meals eaten during the 3 days before onset of symptoms. A culture of the meatloaf yielded S. Newport with a PFGE pattern indistinguishable from the outbreak pattern. Traceback by FSIS of ground beef eaten by 12 New York patients identified a meat packing plant that could have supplied the meat eaten by all those identified in the outbreak. Review of distribution records, grinding logs, and purchasing information did not identify any specific lot of ground beef, and no intact ground beef sample processed by the plant during the outbreak period was available for testing by FSIS. On April 19, USDA issued a Public Health Alert reminding consumers of food safety guidelines. FSIS is examining practices that might contribute to contamination of meat by this pathogen.
one, an antimicrobial agent commonly used to treat serious infections in children. Isolates with this resistance pattern have plasmids that carry a bla<sub>CMY</sub> gene. These genes produce AmpC-type enzymes, which confer resistance to penicillin-inhibitor combinations (e.g., amoxicillin/clavulanate), cephemycins (e.g., cefoxitin), and expanded-spectrum cephalosporins (e.g., ceftiofur and ceftriaxone). To distinguish this type of resistance from other multidrug-resistant strains, these strains are referred to as Newport MDR-AmpC. In 1998, one (1%) of 78 S. Newport isolates tested in NARMS was Newport MDR-AmpC compared with 33 (26%) of 128 in 2001. Although the full clinical significance of Newport MDR-AmpC is unknown, treatment of these infections with ceftriaxone might be ineffective. In addition, antimicrobial-resistant Salmonella infections have been associated with an increased hospitalization rate, morbidity, and mortality.2,3

During 2001-2002, several state health departments, including California, Connecticut, and Massachusetts, documented association of exposure to dairy farms, ill cattle, and cheese made from unpasteurized milk with increased human Newport MDR-AmpC infections.4,6 In the outbreak described in this report, most patients for whom information is available ate lean or extra-lean ground beef, dairy cattle are an important source of lean or extra-lean ground beef.7 These data suggest that cattle, particularly dairy cattle, might be a source for human Newport MDR-AmpC infection.

This report is the first to associate eating of ground beef, specifically raw or undercooked ground beef, with Newport MDR-AmpC infection. Recent U.S. surveys indicate that 11%-28% of persons report eating raw or undercooked ground beef, and approximately one third of persons do not use safe food-handling practices to prevent cross-contamination in the kitchen.8

The USDA Pathogen Reduction/ Hazard Analysis and Critical Control Points (PR/HACCP) inspection system in meat and poultry plants has reduced Salmonella prevalence in raw ground beef from 7.5% in 1998 to 2.8% in 2001.9 The emergence of Newport MDR-AmpC suggests that further measures might be necessary. Potential strategies include (1) evaluating practices on the farm to determine factors that might contribute to multidrug-resistant S. Newport and developing interventions to eliminate these factors; (2) implementing the Public Health Action Plan to Combat Antimicrobial Resistance;10 (3) encouraging industry to implement processes such as steam pasteurization or irradiation of ground beef; and (4) increasing efforts to educate consumers on the importance of safe handling and cooking practices.

State health departments and veterinarians should investigate clusters of S. Newport and perform antimicrobial-susceptibility testing to determine if isolates are Newport MDR-AmpC. Epidemiologic investigations and PFGE comparison of outbreak isolates will help to identify food vehicles associated with Newport MDR-AmpC and to identify control points for reducing these infections. Because treatment with ceftriaxone might be ineffective, clinicians should be informed of the emergence of Newport MDR-AmpC strains. Persons should not eat undercooked ground beef and should wash their hands after handling raw ground beef.

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Resumption of Routine Schedule for Diphtheria and Tetanus Toxoids and Acellular Pertussis Vaccine and for Measles, Mumps, and Rubella Vaccine

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SUPPLIES OF DIPHTHERIA AND TETANUS TOXOIDS AND ACCELLULAR PERTUSSIS (DTAP) VACCINE AND FOR MEASLES, MUMPS, AND RUBEHLA VACCINE
Immunization Practices (ACIP). However, health-care providers should be advised that, for the next 2 months, supply might not be adequate for the initiation of ambitious recall or special initiative programs. With increases in national inventory, more comprehensive recall programs can be established. Child care and school attendance provisions requiring children to receive a DTaP booster and a second dose of MMR vaccine at age 4-6 years can be reinstated.

**DTaP Vaccine**

Three DTaP vaccines are distributed currently in the United States: Tripedia® (Aventis Pasteur, Swiftwater, Pennsylvania), Infanrix™ (GlaxoSmithKline, Philadelphia, Pennsylvania), and DAPTACEL™ (Aventis Pasteur, Toronto, Ontario). The Food and Drug Administration (FDA) approved DAPTACEL™ for use in the United States on May 14, 2002.3 During the DTaP vaccine shortage beginning in 2000,3 ACIP recommended that health-care providers vaccinate infants with the initial 3 DTaP doses, if they did not have sufficient supply of DTaP to vaccinate all children in their practice. ACIP also recommended deferral of the fourth and fifth DTaP doses if supplies were still inadequate.6 Supplies are now adequate to resume the full 5-dose schedule for DTaP vaccine.1,3

**MMR Vaccine**

A temporary shortage of MMR vaccine in the United States resulted from a voluntary interruption of manufacturing operations by Merck & Co., Inc., the only U.S. manufacturer of varicella vaccine.4 During the vaccine shortage, ACIP recommended the delay of the routine childhood varicella vaccine dose from age 12-18 months until age 18-24 months1,2 and made additional recommendations for prioritizing use in the event of a persistent shortage.4 Health-care providers should review the vaccination status of their patients and administer DTaP and MMR vaccines, as appropriate. For at least the next 2 months, providers should order DTaP and MMR vaccine in amounts sufficient for a ≤30-day supply to ensure that current supplies can meet requests. Recall or special initiative programs can be instituted when DTaP and MMR vaccine supply improves further but should be deferred during this transition period. However, if children who need these vaccines seek medical care for other reasons, they should be administered vaccine provided no contraindications exist. Furthermore, vaccine should be offered to children who need vaccination and whose parents requested vaccination. CDC will continue to monitor DTaP and MMR vaccine supply and, if necessary, allocate vaccine. Updates regarding vaccine supply and shortages can be found at http://www.cdc.gov/nip/.

**Vaccine Supply**

Health-care providers should review the vaccination status of their patients and administer DTaP and MMR vaccines, as appropriate. For at least the next 2 months, providers should order DTaP and MMR vaccine in amounts sufficient for a ≤30-day supply to ensure that current supplies can meet requests. Recall or special initiative programs can be instituted when DTaP and MMR vaccine supply improves further but should be deferred during this transition period. However, if children who need these vaccines seek medical care for other reasons, they should be administered vaccine provided no contraindications exist. Furthermore, vaccine should be offered to children who need vaccination and whose parents requested vaccination. CDC will continue to monitor DTaP and MMR vaccine supply and, if necessary, allocate vaccine. Updates regarding vaccine supply and shortages can be found at http://www.cdc.gov/nip/.

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**Resumption of Routine Schedule for Varicella Vaccine**

**SUPPLIES OF VARICELLA VACCINE** (VARIVAX®) in the United States have become sufficient to permit the resumption of the routine schedule as recommended by the Advisory Committee on Immunization Practices (ACIP).1-3 Childcare and school attendance provisions requiring children to receive the varicella vaccine should be reinstated.

A temporary shortage of varicella vaccine in the United States resulted from a voluntary interruption of manufacturing operations by Merck & Co., Inc., the only U.S. manufacturer of varicella vaccine.4 During the vaccine shortage, ACIP recommended the delay of the routine childhood varicella vaccine dose from age 12-18 months until age 18-24 months1-2 and made additional recommendations for prioritizing use in the event of a persistent shortage.4

Health-care providers should review the vaccination status of their patients and administer varicella vaccine as appropriate. Recall programs for deferred unvaccinated persons should be instituted. CDC will continue to monitor vaccine supply. Updates about vaccine supply and shortages are available at http://www.cdc.gov/nip/.

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