Heat-Related Illnesses and Deaths—Missouri, 1998, and United States, 1979-1996

MMWR. 1999;48:469-473
1 figure omitted

Although heat-related illness and death† are readily preventable,3 exposure to extremely high temperatures caused an annual average of 381 deaths in the United States during 1979-1996.6 Basic behavioral and environmental precautions are essential to preventing adverse health outcomes associated with sustained periods of hot weather (daytime heat index‡ of ≥105 F [≥40.6 C] and a nighttime minimum temperature of 80 F [26.7 C] persisting for at least 48 hours). This report describes four heat-related deaths that occurred in Missouri during 1998, summarizes heat-related deaths in the United States during 1979-1996, describes risk factors associated with heat-related illness and death, especially in susceptible populations (young and elderly, chronically ill, and disabled persons), and recommends preventive measures.

Case Reports
Case 1. In June 1998, a 92-year-old man was admitted to a city hospital emergency department. He was unresponsive to stimuli, had a heart rate of 170 beats per minute, a rectal temperature of 105.6 F (40.9 C), and a history of heart disease. The medical examiner’s report listed the cause of death as hyperthermia as a result of exposure to high environmental temperature. To conserve electricity, his family had not been running the air conditioner in their residence. The daytime heat index recorded at the local airport during the 5 days preceding his death ranged from 102 F to 109 F (38.9 C to 42.8 C).

Case 2. In July 1998 at 4:47 PM, a 4-year-old girl was found in a locked car in front of a child care center. She had disappeared from the center at approximately 10 AM. Cardiopulmonary resuscitation was administered on the scene, but rigor mortis already had occurred. Death was attributed to hyperthermia. The temperature inside the car at the time of her death was unknown; however, the estimated heat index in the area that day was 93 F (33.9 C).

Case 3. In July 1998, a 70-year-old woman was found dead in a mobile home. When she was discovered, the air conditioner was blowing hot air, and the temperature inside the mobile home was approximately 115 F (46 C). The autopsy report indicated that she suffered from congestive heart failure, arthritis, and chronic obstructive pulmonary disease, and that death was caused by pulmonary insufficiency brought about by exposure to excessive heat.

Case 4. In July 1998, a 42-year-old man was found dead in his apartment. His partially decomposed body was discovered by police officers investigating reports of a foul odor. The air conditioner was not on. The heat index at the city airport when the man was last seen alive was 93 F (33.9 C). The man had schizophrenia and was under psychiatric care. He also was a heavy smoker and had emphysema. The medical examiner’s report indicated that the cause of death was hyperthermia.

Missouri
During 1979-1996, the years for which data are available, Missouri had the second highest age-adjusted rate for heat-related deaths “due to weather conditions”‡ (3 per 1 million population) in the United States. During 1998, after reviewing death certificates, the Missouri Department of Health attributed 12 deaths to high temperatures, and the state’s heat surveillance system recorded 470 heat-related illnesses: the average age among decedents was 65.6 years (range: 4-92 years; median 73.5 years); seven (58%) decedents were female.

United States
During 1979-1996, an annual average of 381 deaths in the United States6 were attributable to “excessive heat exposure” (range: 148 in 1979 to 1700 in 1980), for an average age-adjusted rate of 2 deaths per 1 million population. During this 18-year period, 6864 deaths were attributable to excessive heat exposure: 2914 (42%) “due to weather conditions,” 343 (5%) “of man-made origin,” and 3607 (53%) “of unspecified origin.” Of the 2862 persons whose death was caused by weather conditions and for whom age data were available, 1745 (61%) were aged ≥55 years, and 19 (4%) were <14 years. Approximately half of all heat-related deaths occurred among persons aged greater than or equal to 65 years. During 1979-1996, the annual age-adjusted death rate for hyperthermia in this age group was 6 per 1 million. Among persons aged ≥35 years, the annual death rate “due to weather conditions” was 1.7 times higher for men (1.5 per 1 million) than for women (0.9 per 1 million), and four times higher for blacks (four per 1 million) than for whites (0.9 per 1 million).

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CDC Editorial Note: All persons are at risk for hyperthermia when exposed to a sustained period of excessive heat.2 The cases described in this report illustrate risk factors associated with heat-related mortality, including age (the young and the elderly), medical history (e.g., cardiovascular disease), social circumstances (e.g., living alone), chronic health conditions (e.g., respiratory diseases), and other conditions.
that might interfere with the ability to care for oneself.²,³

Also contributing to heat-related illness are alcohol consumption (which may cause dehydration), previous heatstroke, physical activity (e.g., exertion in exceptionally hot environments during work or recreation), and the use of medications that interfere with the body's heat regulatory system, such as neuroleptics (antipsychotics or major tranquilizers) and medications with anticholinergic effects (e.g., tricyclic antidepressants, antihistamines, some antiparkinsonian agents, and some over-the-counter sleeping pills).²,⁴ Although the annual death rate from hyperthermia is higher for men aged ≥35 years and for black persons than for women aged ≥35 years and white persons, the reasons for these differences have not been identified.⁵

Illnesses associated with high environmental temperatures include heatstroke (hyperthermia), heat exhaustion, heat syncope, and heat cramps.³ Heatstroke is a medical emergency characterized by the rapid onset and increase (within minutes) of the core body temperature to ≥105°F (≥40.6°C) and lethargy, disorientation, delirium, and coma.² Heatstroke is often fatal despite medical care directed at rapidly lowering the body temperature (e.g., ice baths) because in many cases irreparable neurologic damage has occurred.² Heat exhaustion is characterized by dizziness, weakness, or fatigue often following several days of sustained exposure to hot temperatures and results from dehydration or electrolyte imbalance;² treatment includes replacing fluids and electrolytes and may require hospitalization.² Physical exertion during hot weather increases the likelihood of heat syncope and heat cramps caused by peripheral vasodilatation.² Persons who lose consciousness because of heat syncope should be placed in a recumbent position with feet elevated and given fluid and electrolyte replacement.² For heat cramps, physical exertion should be discontinued and fluids and electrolytes replaced.²,⁷

Persons working either indoors or outdoors in high temperatures should take special precautions, including allowing 10-14 days to acclimate to high temperatures. Although adequate salt intake is important, salt tablets are not recommended and may be hazardous to many people.² Although the use of fans may increase comfort at temperatures <90°F (<32.2°C), they are not protective against heatstroke when temperatures reach ≧90°F (≥32.2°C) and humidity is >33%.²,⁴

Measures for preventing heat-related illness and death include spending time in air-conditioned environments, increasing nonalcoholic fluid intake, exercising only during cooler parts of the day, and taking cool-water baths.² Elderly persons should be encouraged to take advantage of air-conditioned environments (e.g., shopping malls and public libraries), even if only for part of the day.²,⁴

Public health information about exceptionally high temperatures should be directed toward susceptible populations. For example, parents should be educated about the heat sensitivity of children aged <5 years.² When a heat wave is predicted, friends, relatives, and neighbors should make an effort to check on elderly, disabled, and homebound persons, and during periods of high temperatures, prevention messages about avoiding heat-related illness should be disseminated as early as possible to prevent heat-related illness, injury, and death.

Trends in HIV-Related Sexual Risk Behaviors Among High School Students—Selected US Cities, 1991-1997

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2 tables omitted

Despite recent decreases in sexual risk behaviors among high school students nationwide,¹ human immunodeficiency virus (HIV) infection was the seventh leading cause of death among persons aged 15-24 years in the United States during 1997.² To determine whether the prevalence of HIV-related sexual risk behaviors among high school students also has decreased in certain urban areas heavily affected by the epidemic, CDC analyzed data from Youth Risk Behavior

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*The National Association of Medical Examiners’ (NAME) definition of heat-related death includes exposure to high ambient temperature either causing the death or substantially contributing to it, cases where the body temperature at the time of collapse was ≥105°F (≥40.6°C), and a history of exposure to high ambient temperature and the reasonable exclusion of other causes of hyperthermia.¹ Because death rates from other causes (e.g., cardiovascular and respiratory disease) increase during heat waves² (defined by the National Weather Service as ≥3 consecutive days of temperatures ≥90°F [≥32.2°C]), deaths classified as caused by hyperthermia represent only a portion of heat-related mortality.

† Underlying cause of death attributed to “excessive heat exposure,” classified according to the International Classification of Diseases, Ninth Revision (ICD-9), as code E900.0, “due to weather conditions” (deaths); code E900.1, “of man-made origin” (deaths); or code E900.9, “of unspecified origin” (deaths). These data were obtained from the Compressed Mortality File (CMF) of CDC’s National Center for Health Statistics, which contains information from death certificates filed in 50 states and the District of Columbia. All rates were age-standardized to the 1990 U.S. population.
Surveys (YRBS) conducted in 1991, 1993, 1995, and 1997 in eight large-city school districts: Boston, Massachusetts; Chicago, Illinois; Dallas, Texas; Fort Lauderdale, Florida; Jersey City, New Jersey; Miami, Florida; Philadelphia, Pennsylvania; and San Diego, California. This report summarizes the results of this analysis, which indicate that, from 1991 to 1997, the percentage of high school students engaging in HIV-related sexual risk behaviors decreased in some U.S. cities.

The local YRBS, a component of CDC’s Youth Risk Behavior Surveillance System, measures the prevalence of health-risk behaviors among adolescents through representative school-based surveys conducted biennially in selected city school districts. The 1991, 1993, 1995, and 1997 surveys used a two-stage cluster sample design to produce representative cross-sectional samples of students in grades 9-12. The school districts in this report obtained weighted data (i.e., had a scientifically selected sample, an overall response rate of at least 60%, and appropriate survey documentation) for at least 3 of the 4 years. Across all districts and years, sample sizes ranged from 369 to 3343; school response rates ranged from 81% to 100%; student response rates ranged from 62% to 85%; and overall response rates ranged from 60% to 85%.

For each survey, students completed an anonymous self-administered questionnaire that included questions about sexual intercourse, number of sex partners, and condom use. Sexual experience was defined as ever having had sexual intercourse, multiple sex partners as having had four or more sex partners during one’s lifetime, current sexual activity as having had sexual intercourse during the 3 months preceding the survey, and condom use as having used a condom at last sexual intercourse among currently sexually active students. Data for racial/ethnic groups other than non-Hispanic black, non-Hispanic white, and Hispanic were combined because, when presented separately, sample sizes were too small for meaningful analysis.

Data were weighted to provide estimates generalizable to all public school students in grades 9-12 in the respective jurisdictions. SUDAAN was used to calculate 95% confidence intervals (CIs) and to conduct trend analyses. The percentage change in behavior from 1991 to 1997 was calculated as the 1997 prevalence minus the 1991 prevalence divided by the 1991 prevalence and multiplied by 100. Secular trends were analyzed using logistic regression analyses that controlled for sex, school grade, and race/ethnicity. This report provides results from tests of linear trends. For Boston, 1991 data were not available; therefore, Boston’s trend analyses were calculated from 1993 to 1997. For Philadelphia, 1993 data were not available; trend analyses for that city excluded data for that year.

Demographic characteristics of the respondents in 1997 closely matched the characteristics of the respondents in 1991, 1993, and 1995. Respondents were distributed evenly across sex and school grade, with slightly smaller percentages of 12th-grade students. The racial/ethnic distributions varied among cities, but generally had larger proportions of black and Hispanic students than of white students.

From 1991 to 1997, the proportion of sexually experienced students decreased significantly in Chicago, Dallas, and Fort Lauderdale; in Boston, the proportion of sexually experienced students decreased significantly from 1993 to 1997. The percentage decrease in these cities ranged from 7% in Dallas to 16% in Chicago. The prevalence of multiple sex partners among students in the same four cities decreased significantly. The percentage decrease in these four cities ranged from 12% in Fort Lauderdale to 33% in Chicago.

From 1991 to 1997, the proportion of students in Chicago, Dallas, Fort Lauderdale, and Philadelphia who reported current sexual activity decreased significantly. The percentage decrease in these cities ranged from 8% in Dallas to 16% in Chicago.

Condom use among currently sexually active students increased significantly in Chicago, Dallas, Fort Lauderdale, Jersey City, Miami, and Philadelphia from 1991 to 1997. The percentage increase in these cities ranged from 25% in Dallas to 52% in Jersey City.

Reported by: Div of Adolescent and School Health, National Center for Chronic Disease Prevention and Health Promotion; Div of HIV/AIDS Prevention-Intervention, Research, and Support, National Center for HIV, STD, and TB Prevention, CDC.

CDC Editorial Note: Students in all but one of the eight U.S. cities examined in this study demonstrated a significant improvement in at least one HIV-related sexual risk behavior. The decrease in the percentage of urban students reporting sexual experience and multiple sex partners parallels recent national trends in these health-risk behaviors and represents a reversal of the increasing trend that occurred nationally during the 1970s and 1980s. The increase in four cities in the percentage of currently sexually active students reporting condom use also parallels national trends. Although the percentage of currently sexually active students remained stable nationally from 1991 to 1997, this percentage decreased significantly in four of the eight cities included in this report. Declines in sexual risk behaviors among students in these cities are important because these cities have large black and Hispanic populations who have disproportionately higher rates of HIV infection.

The findings in this report are subject to at least three limitations. First, although data for each school district represent students in that jurisdiction, these school districts do not represent all cities heavily affected by the HIV epidemic. Second, these data apply only to adolescents who attended public high school. In the three cities for which data are available, 1996 high school dropout rates ranged from 3% in San Diego to 12% in Philadelphia. Adolescents not enrolled in school are more likely to be sexually experienced and to have had multiple sex partners than adolescents enrolled in school. Finally, the extent of under-
reporting or overreporting cannot be determined, although the survey questions demonstrate good test-retest reliability.\(^8\)

In 1987, CDC began providing fiscal and technical support to local education agencies in these and other cities where the prevalence of acquired immunodeficiency syndrome (AIDS) is high. This support assists schools in implementing HIV-prevention policies and programs for adolescents. For example, in Boston and Miami, the local education agency requires high schools to use a curriculum with demonstrated effectiveness in reducing sexual risk behaviors. In Chicago, high school students participate in peer education to develop social skills to avoid peer pressure. In Dallas, school nursing and counseling services support the HIV-prevention program. In Fort Lauderdale, school-based health centers provide health-care services to students at school, including referrals for HIV counseling and testing. CDC also provides fiscal and technical support to local community planning groups to plan and implement HIV-prevention programs and services for adolescents. The decreases in sexual risk behaviors among high school students in the eight cities analyzed in this report may reflect the impact of these and other efforts, including those of families, local government agencies, and community-based organizations.

Despite the reductions in risk for HIV infection among urban adolescents, many remain at risk. Although school-based HIV-prevention education is widely conducted in U.S. schools, efforts are needed to identify and disseminate effective curricula that can help students avoid risk for HIV infection and to increase the percentage of teachers who receive in-service training in HIV prevention.\(^9\) Community interventions should reinforce school-based HIV prevention and provide additional HIV-related services to all adolescents, particularly those at greatest risk for HIV infection.

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Availability of Updated HIV Treatment Guidelines

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TWO HIV-RELATED TREATMENT GUIDELINES have been updated. “Guidelines for the Use of Antiretroviral Agents in HIV-Infected Adults and Adolescents,” prepared by the U.S. Department of Health and Human Services and the Henry J. Kaiser Foundation Panel on Clinical Practices for Treatment of HIV Infection, has been updated several times since publication in MMWR.\(^1\) The most recent update contains information about the newly licensed nucleoside reverse transcriptase inhibitor, abacavir (Ziagen\(^*\)).

In addition, the Working Group on Antiretroviral Therapy and Medical Management of HIV-Infected Children, comprising specialists caring for HIV-infected infants, children, and adolescents, has updated “Guidelines for the Use of Antiretroviral Agents in Pediatric HIV Infection.”\(^2\) These guidelines include information about the use of abacavir (Ziagen\(^*\)) and the use of efavirenz (Sustiva\(^*\)), a non-nucleoside reverse transcriptase inhibitor, for treating HIV infection in children. Also included is updated information about the newly available liquid preparation of nevirapine (Viramune\(^*\)) for pediatric use.

The updates are available from the World-Wide Web site of the HIV/AIDS Treatment Information Service (ATIS) at http://www.hivatis.org,\(^*\) or from ATIS, telephone (800) 448-0440.

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