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Public Health Consequences of a Flood Disaster—Iowa, 1993

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UNPRECEDENTED amounts of rain in the spring and summer of 1993 led to disastrous flooding and crop damage in nine Midwestern states. In Iowa (1990 population: 2 777 000), extensive flood damage occurred in all 99 counties. On July 11, 1993, the Iowa Department of Public Health (IDPH) requested assistance from CDC to assess the adverse public health impact of the flooding and to plan the public health response to the disaster. CDC assisted IDPH in performing an initial rapid statewide public health assessment and establishing weekly surveillance to monitor ongoing or anticipated flood-related health problems. This report summarizes the methods of the assessment and surveillance and preliminary findings.

On July 15 and 16, IDPH conducted a telephone survey of all 99 county public health officers to assess the impact of the flood on the state's public health infrastructure. Interviewers used a standardized questionnaire to gather information regarding the availability of medical, pharmaceutical, and public health services; operations of public water, sewer, and solid-waste disposal systems; presence of toxic hazards; and increases in the presence of vectors (e.g., rodents or biting insects).

Five of the 99 counties, representing 14% of Iowa's population, reported closures of primary-care physician offices. Closures per county ranged from one office in Van Buren County (1990 population: 7676) to approximately 200 offices in Polk County (1990 population: 324 140). Eight counties (24% of the state population) reported interruptions in public health services (e.g., vaccination clinics; Special Supplemental Food Program for Women, Infants, and Children; and sexually transmitted diseases clinics). Every county had at least one operating pharmacy. Des Moines, in Polk County, was the only community without an operating public water system; the loss of this system affected more than 250 000 persons (9% of the population). Ten counties (15% of the population) reported at least one nonoperational public sewer system, and 45 counties (53% of the population) reported vector problems.

Because flood-related public health problems were expected to continue into the recovery phase of this disaster, IDPH established a special statewide public health surveillance system. In this system, county public health officers complete weekly questionnaires, based on information obtained from area medical, mental health, and substance-abuse facilities, and county sanitation departments. The questionnaires ask whether, since the last report, the availability of medical or public health services has deteriorated and whether increases above baseline have occurred in reported cases of diarrheal illnesses, admissions for flood-related illnesses or injuries, or admissions to substance-abuse or mental health programs. Other information obtained includes the number of public or private water or sewer systems in need of rehabilitation, whether solid-waste collection or disposal efforts have been hampered, and whether vectors are a problem.

For the week of July 18-24, the number of counties reporting limitations in availability of medical or public health services decreased from eight (24% of the population) during the July 15-16 assessment to four (3% of the population). No outbreaks of diarrheal disease were identified. Seven counties (14% of the population) reported persons hospitalized for the following flood-related illnesses or injuries: carbon monoxide poisoning (related to the indoor use of gasoline-powered generators), hypothermia, electrocution, wound infections, and exacerbation of chronic illnesses. Two counties (2% of the population) reported increases in admissions to substance-abuse programs, and nine counties (16% of the population) reported increases in admissions to mental health facilities. Twenty-nine counties (37% of the population) reported flood damage to water systems, and 31 counties (35% of the population) reported flood damage to sewer systems. The number of damaged systems (mostly private) per county ranged from one to 1000.

Twelve counties (12% of the population) reported problems with solid-waste disposal; 35 counties (33% of the population) reported increased complaints about mosquitoes and rats—a decrease from 45 counties on July 16. These surveillance results were validated and other local concerns were identified on July 27-28 when multidisciplinary IDPH teams (medical, environmental, and social services) met with local officials (government, emergency preparedness, hospital, public health, and social services) in the 12 most severely affected counties.

To ensure detection of possible waterborne infectious disease outbreaks and flood-related injuries, on July 16, IDPH established an ad hoc surveillance system employing 17 outpatient facilities to monitor the daily number of visits for diarrheal illnesses and flood-related injuries (i.e., heat, musculoskeletal, puncture/laceration, head, animal bite, poisoning, and electrical). As of August 6, when this surveillance was discontinued, no outbreaks of waterborne diseases were identified. In addition to one death from electrocution, five nonfatal cases of carbon monoxide poisoning were reported.

The entomology department at Iowa State University and the University State Hygienic Laboratory at the University of Iowa have maintained an ongoing statewide arbovirus surveillance program since 1968. Mosquitoes are collected daily from New Jersey traps in six major Iowa cities. Carbon dioxide-baited CDC light traps are used periodically to monitor virus activity in vector populations in these cities, and sentinel chicken flocks are located in eastern, western, and central Iowa. On July

14, populations of *Culex tarsalis*, an important vector of western equine encephalitis, were at extremely high levels (176 *Cx. tarsalis* per carbon dioxide-baited trap per night) in western Iowa. *Cx. tarsalis* populations also were increased above baseline in the eastern part of the state. However, as of August 19, seroconversions had not been detected in sentinel chicken flocks.

Reported by: CG Atchison, Director, LA Wintermeyer, MD, State Epidemiologist, JR Kelly, Div of Health Protection, R Currier, DVM, Bur of Environmental Epidemiology, Div of Health Protection, C Vogel, JH Goddard, Bur of Infectious Diseases, M Weaver, Div of Family and Community Health, J Culp, Bur of Maternal and Child Health, J Zwick, Div of Substance Abuse and Health Promotion, RD Eckoff, MD, Substance Abuse and Health Promotion, Integrated Statewide Public Health Assessment Model for Iowa, Iowa Dept of Public Health; WJ Hausler, Jr, PhD, NF Moyer, PhD, Univ State Hygienic Laboratory, Univ of Iowa, Iowa City; WA Rowley, PhD, Dept of Entomology, Iowa State Univ, Ames; G Schwartz, Employee Health, J Knutsen, Emergency Room Svcs, Samaritan Health Systems, Clinton. Emergency Response Coordination Group, and Disaster Assessment and Epidemiology Section, Health Studies Br, Div of Environmental Hazards and Health Effects, National Center for Environmental Health; Parasitic Diseases Br, Div of Parasitic Diseases, and Div of Vector-Borne Infectious Diseases, National Center for Infectious Diseases, CDC.

CDC Editorial Note: Flooding is the most common type of natural disaster worldwide, accounting for an estimated 40% of all natural disasters.[1] In riverine flooding, water levels can rise to flood stage gradually or very rapidly (i.e., flash flood) from snow melt or heavy or repeated rains. During the 1993 midwestern flood disaster, both gradual and flash flooding occurred.

Flash flooding is the leading cause of weather-related mortality in the United States (accounting for approximately 200 deaths per year).[1] However, the public health impact of floods also includes damage or destruction to homes and displacement of the occupants that may, in turn, facilitate the spread of some infectious diseases because of crowded living conditions and compromised personal hygiene (i.e., hand washing). Stress-related mental health or substance-abuse problems may be associated with flood disasters.[1,2] As the findings in this report indicate, medical and public health services may be interrupted in affected communities. Finally, the occurrence of injuries may increase during the clean-up phase of a disaster.[3]

The multiple environmental consequences of flooding can directly affect the public's health. For example, water sources can become contaminated with fecal material or toxic chemicals, water or sewer systems can be disrupted, dangerous substances can be released (e.g., propane from damaged storage tanks), and solid-waste collection and disposal can be disrupted. In addition, flooding can result in vector-associated problems, including increases in mosquito populations that, under certain circumstances, increase the risk for some mosquitoborne infectious diseases (e.g., viral encephalitis).[4,5]

Floods and other natural disasters often are followed by rumors of epidemics (e.g., typhoid, cholera, or rabies)[6,7] or unusual conditions such as increased snake or dog bites. Such unsubstantiated reports can gain public credibility when printed in newspapers or reported on television or radio as facts. The potential for such rumors underscores the need for valid and systematically collected data and the importance of basic public health surveillance in such settings. Elements to be considered in such surveillance efforts are described in the CDC publication Beyond the Flood: A Prevention Guide for Personal Health and Safety,[8] which emphasizes the importance of 1) purification of drinking and cooking water; 2) disinfection of wells; 3) food safety (i.e., handling of food that may have come in contact with flood water or of refrigerated food after the interruption of electrical power); 4) sanitation and personal hygiene; 5) injury-prevention measures to be taken during the return to and cleaning up of flooded homes; 6) communicable diseases and vaccinations; 7) mosquito control; and 8) other hazards such as animals, chemicals, and swift-flowing water. Copies of the guide are available from state health departments.

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