



Diabetes, disasters and decisions

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Practice Points

- Man-made and natural disasters can impact people with diabetes even more severely than they impact others.
- Both public and private agencies can learn from past disasters and develop strategies to address the needs of people with diabetes at all stages (prevention and preparation during predisaster planning, mitigation activities during the disaster, and response and recovery activities postdisaster).
- Resources exist in the public domain to help people with diabetes and their caregivers to prepare for disasters.

SUMMARY Man-made and natural disasters pose special challenges for people with diabetes. The disruption of healthcare delivery systems can have both short- and long-term health impacts. Disaster training programs should educate people with diabetes and their caregivers, emergency personnel, and other healthcare professionals about disaster prevention, mitigation and recovery. Early planning can prevent later disaster-related exacerbations of diabetes.

The International Diabetes Federation estimates that, approximately 285 million people have diabetes worldwide. This is expected to rise to 438 million by 2030 [1,101]. Worldwide increases in diabetes prevalence have led to an increase in the numbers of people with diabetes affected by disasters, such as hurricanes, earthquakes, heat waves, tornados, floods, pandemics, terrorism or wars [2–9,102,103].

In the aftermath of disasters, there may be destruction of the environment, temperature changes, power outages, and shortages of food, clothing and shelter. Acute conditions, such as poor sanitation, can lead to infections. Access to medical facilities, providers, medical records, and medications is limited. This limited access is a leading cause of postdisaster mortality [2].

Diabetes and its comorbidities, often exacerbated by disasters, present a challenge to both public and private recovery efforts [2,3].

Following disasters, glycemic control among people with diabetes deteriorates [10–13]. People with diabetes are at increased risk for morbidity and mortality caused by complications, such as diabetic ketoacidosis and foot infections, and emergency department (ED) visits for people with diabetes increase [14,15]. Certain groups, such as the elderly, people of low socioeconomic status, people without health insurance, and many minorities, become even more vulnerable during disasters and experience increased morbidity and mortality [1,8,16,17,104]. An increase in admissions of people with newly-diagnosed Type 1 diabetes has also been reported postdisaster [18].

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During disasters, many people with diabetes are evacuated from their homes. It is possible that those placed in evacuee centers or shelters can have their medical conditions managed by relief teams with little knowledge of diabetes (although there is a wide spectrum of knowledge and training). In addition, many evacuate without essential medical supplies, such as glucose monitoring equipment, or medications, such as insulin and oral agents for diabetes. Many lack a list of medications or copies of prescriptions and medical records, and subsequently find it difficult to continue their daily regimens [7].

Medical relief efforts following disasters have traditionally focused on the affected population's immediate needs [3,8,14,15]. These efforts are vital, but for people with diabetes, continuity of care is also needed. Planning must address the needs of people with diabetes before, during, and after a disaster [5,6,19].

Background: lessons from historic disasters

■ Hurricane Katrina (2005)

Estimates of the prevalence of diagnosed diabetes in the population of people evacuated because of hurricane Katrina have varied from 9 to 17%, or 87,000–100,000 people [3,19,20]. Many more probably had undiagnosed diabetes, since some of the affected states had high rates of obesity and sedentary lifestyle. Diabetes was among the leading causes of outpatient office visits and ED visits post-hurricane Katrina in both the affected area and in areas that received evacuees [4,7,21–23]. Many of those displaced to shelters due to Hurricane Katrina had a significant burden of disease, socioeconomic vulnerability, and limited healthcare access; factors that are associated with exacerbation of pre-existing conditions. Cases of gangrene and diabetic ketoacidosis were reported in shelters. There were also new cases of diabetes reported as well, adding to the burden. An inventory of Louisiana shelters showed a wide variation in the capacity to care for people with chronic conditions [16,24–26]. Post-Hurricane Katrina, people with diabetes faced less healthy diets, a lack of diabetes medication, lack of physical activity and infection. Comorbidities, such as hypertension, were exacerbated. The short-term diabetes management goals were to prevent acute complications, such as hyperosmolar-nonketotic states and severe hypoglycemia.

After hurricane Katrina, many pharmacies were destroyed or unable to open. Patients who lost their medications and supplies were unable to replace them. Of the 160 clinics operating pre-Katrina, only 19 remained after the storm, with a net loss of 6000 health professionals [14,15,23]. A total of 32% of the Federally Qualified Health Centers in the areas that Hurricane Katrina affected, which often provided healthcare services to at-risk populations, were destroyed or severely damaged.

The American Diabetes Association (ADA) responded to Hurricane Katrina by increasing volunteer efforts to provide diabetes expertise to the affected areas, and by providing diabetes educators to primary care disaster relief teams to help with insulin adjustment and general diabetes education [6,19]. During Hurricane Katrina, the ADA worked with relief agencies and pharmaceutical and diabetes supplies companies to aid in the dissemination of products in the affected areas. The ADA network helped with relief efforts and developed distribution networks.

The ADA and Centers for Disease Control and Prevention (CDC) developed a hurricane website as a resource tool that helped with relief efforts and helped disseminate information and supplies.

■ Hurricanes Iniki (1992), Andrew (1992), Marilyn (1995) & Charley (2004)

After the 1992 Hurricane Iniki in Kauai, Hawaii, diabetes-related deaths increased by 161% [27]. A total of 24% of people affected by the 1992 Category 5 Hurricane Andrew in Florida had diabetes [28]. A special operations response team found that insulin supplies were depleted within 24 h [29]. Older adults experienced especially severe disruptions in quality of life and in medical care [30]. Similarly, following the September 1995 Category 3 Hurricane Marilyn in the US Virgin Islands, insulin-loaded syringes were among the most needed supplies by the elderly [31].

Following standard operating procedures, a rapid needs assessment was conducted in the first 3–5 days after Hurricane Charley in 2004, focusing on immediate issues such as injury, food, clothing, and shelter, but not on pre-existing medical conditions. A more detailed assessment that focused on other issues, including identification of pre-existing chronic conditions such as diabetes, was carried out 10–14 days after the hurricane struck. The study concluded

that a rapid-needs assessments focusing on the needs of people with chronic conditions should be conducted 3–5 days post-hurricane rather than the usual 10–14 days so that appropriate medications and supplies could be deployed earlier [32].

■ **The Hanshin/Kobe (1995), Hanshin/Awashi (1995) & Kashmir (2005) earthquakes**

Several studies have looked at the effects of the Hanshin/Kobe and Hanshin/Awashi earthquakes on people with diabetes [10,12,33–36]. Diabetic complications included ketoacidosis, hyperosmolar-nonketotic comas, hypoglycemic comas, gangrene and other soft tissue infections, pneumonia, and brain hemorrhage. Long-term complications included worsening diabetic nephropathy necessitating new hemodialysis, poorly controlled blood pressure, stroke, increased retinopathy, worsening of cataracts, and tuberculosis infection [8,12]. Baba *et al.* reported that supplies of insulin and other drugs for diabetes treatment were depleted, and people with diabetes experienced increased anxiety because they could not reach their doctors and experienced changes in medication regimens [37]. Kirizuka *et al.* studied the Hanshin/Kobe earthquake's effects on glycemic control [12]. The mean baseline hemoglobin A1C of people with diabetes was 7.74% in December 1994, pre earthquake, and 8.34% in March 1995, postearthquake. After the Hanshin/Awashi earthquake, even patients who still had access to their medications experienced a significant increase in A1C levels. Similar to Hurricane Katrina, factors that contributed to poor glycemic control included loss of medication and lack of access to replacement medications, as well as variation in capacity of shelter workers to assist with diabetes care. By September 1995, A1C had returned to pre earthquake levels.

In October 2005, an earthquake measuring 7.6 on the Richter scale struck Pakistan's autonomous state of Kashmir and part of Indian-administrated Kashmir. The official death toll in Pakistan was 79,000 and nearly 1400 in India. Diabetic supplies were rapidly depleted and not replenished. Treatment for uncontrolled diabetes was restricted to hydration [13,38]. A 3-week health needs assessment showed that the chronic disease management needs of older rural people, including those with diabetes, were not adequately addressed [39].

■ **2006 Californian heat wave**

Knowlton *et al.* reported that, during the 2006 California heat wave, 16,166 excess ED visits and 1182 excess hospitalizations occurred statewide [40]. The number of ED visits, but not hospitalizations, dramatically increased for people with diabetes, especially in the over 65 year age group. This study suggested that communities could better prepare by understanding the vulnerabilities of affected populations.

■ **War**

One study of people with Type 2 diabetes affected by the 1991 Gulf War found that the mean A1C increased from 10.1 to 10.9%, and the population's mean weight increased from 76.1 to 77.5 kg. In people with Type 1 diabetes, A1C levels increased from 9.6 to 10.2%, and the mean weight increased from 63.2 to 64.7 kg. A1C levels even increased in people without weight gain. A1C levels returned to baseline after the war. Possible causes of the deterioration of glycemic control were similar to those associated with natural disasters [41].

Amital looked at evacuated civilian victims of the 1999 war in Kosovo [42]. Most visits to field hospitals were for medical purposes, such as treatment for diabetes and other chronic conditions, and for access to medication [42]. Studies of the effects of the 1990 war in Croatia upon people with Type 2 diabetes showed greater stress in evacuees than in people who were not displaced, but no differences in A1C levels, body weight or medication dosage were seen [43,44].

Public health implications & future directions

Public health preparedness strategies must address both immediate and long-term health needs of people with diabetes and their comorbidities such as hypertension, hyperlipidemia, cardiovascular disease, chronic kidney disease and visual impairment. To build community resiliency and increase affected and surrounding areas' ability to rebuild after a disaster, public health agencies should share knowledge of basic and surge capacity of healthcare delivery systems [2,45–47]. The need to strengthen the capacity to respond to the postdisaster needs of people with chronic disease, particularly older people, is great [8,39,46].

Dobalian *et al.* addressed some key issues, based on the Essential Public Health Services Model, related to developing a needs assessment of public health preparedness in rural areas [45].

Healthcare professionals and organizations require targeted, tailored education and communications about the preparedness needs for people with diabetes and other comorbid conditions (see information resources) [2,8,19,48,49]. The issues considered included: local-level disease surveillance programs; the infrastructure that provides acute and chronic care to people with chronic conditions; current and potential postevent deficiencies that might contribute to disease or lack of continuing care; custodial care issues and worker safety; and resources, networks and partnerships available from stakeholders and programs to educate and inform local providers about preparedness and diabetes and its relevancy to existing healthcare needs.

Action steps for disaster planning that address the needs of people with diabetes

■ Use of surveillance data & information technology

To effectively develop a general community resiliency program that includes prevention, mitigation and recovery planning, communities should calculate the burden of diabetes and other chronic diseases before the disaster occurs, so appropriate medicines and shelter supplies can be stockpiled [2,102]. The CDC has developed US county-level estimates of diabetes prevalence that can provide necessary data. The Behavioral Risk Factor Surveillance System (BRFSS) can often provide baseline data regarding the prevalence of other chronic conditions. Information technology plays a crucial role in pre-, during- and post-disaster planning. If available, electronic medical records can help multiple institutions to communicate with each other. Portable summary documentation of diagnoses and medications, with appropriate storage, transfer, and distant access capability, should be developed before disasters and back-up plans for access to information should be established [8,14,15]. Portable rapid triage tools should also be available [49,105].

■ Education & training

The widespread lack of education about disaster preparedness for people with diabetes and their caregivers is well documented. Predisaster education and preparedness should be part of a standard diabetes self management program [8,15,19,46,106,107]. Key information that should be given to people with diabetes and their caregivers about what to do to be prepared appears in (Box 1) [3,8,17,19,51–53,106–109].

Healthcare professionals and organizations require targeted, tailored education and communications about the preparedness needs for people with diabetes and other comorbid conditions (see information resources) [8,19,54–56,110]. Personnel with specialized diabetes knowledge should participate in disaster planning, training and relief efforts [2,8,15].

Depression, often exacerbated after a disaster, is a common pre-existing comorbidity of diabetes. Lack of sleep, uncertainty about the status of family members and an increased demand for coping skills are some challenges to a person's mental health. Providers should be aware of the short- and long-term psychological needs of people with diabetes [45]. The emotional and medical needs of the responders themselves, who might find the stress of dealing with an emergency overwhelming, also must be considered [46].

Policies that support training for health professionals in caring for the special needs of people with diabetes should be in place. Similar training should be available in medical and nursing schools and throughout public health institutions. Such training should be part of emergency relief training. Knowledge of existing community healthcare services, including basic and surge capacity of healthcare delivery systems to treat and manage diabetes before and after an event, can help to build community partnerships that will establish local networks responsible for disaster response and recovery [2,46,56,57,110–112]. Training of first responders by people knowledgeable about diabetes should become a routine part of emergency preparedness.

■ Shelters

People with diabetes in shelters can experience difficulty monitoring blood glucose owing to lack of supplies and proper sanitation. They can also experience unavailability of medications, lack of sleeping space, increased risk for infections and unmet dietary needs. Treatment of diabetes and its comorbidities is often delayed until emergency help is needed [8].

Medication regimens are often based on patient recall, since medical records are often unavailable. Even if records are available, treatment is limited to medications available in the shelter. Many people remain in shelters for extended periods of time so access to medications and long-term storage of insulin, for example, may be difficult.

Box 1. Emergency preparedness considerations for people with diabetes.

- Know your medical diagnoses, including diabetes, and how a disaster might affect them
- Have a list of your regular healthcare providers and their contact information
- Have copies of prescriptions or printouts from your pharmacy listing your medications and information on how to care for them.
- Know basic self-care skills
- Learn about stress management skills
- Check feet daily for open sores
- Wear protective footwear
- Know nutrition options that will be useful in a disaster, such as what to take on a camping trip, or what to eat when the power goes off (see below for examples of suggested foods)
- Know about food safety principles [114]
- Know about 'sick day' rules
- Know about low and high blood sugar treatments
- Wear medical alert emergency identification
- Assemble a disaster supply kit – review the kit every 2–3 months to be sure supplies have not expired (see below for suggested kit contents)
- Know about general emergency principles and basic safety information
- Be sure you have developed a plan with your family/caregivers about where to meet after a disaster
- Be aware of surroundings, and watch for hazards from the debris that often accompanies a disaster
- Know about the location of shelters and possible medical care options

Examples of items for an emergency kit for people with diabetes

- 2-week supply, although some groups recommend a 30-day supply [8,19,51,109]:
 - Alcohol swabs
 - Blood glucose monitoring supplies (meter to measure blood sugar, strips to use with meter or strips for visual reading, lancets and lancet device, blood sugar testing diary)
 - Sharps container to safely dispose of needles and other sharps
 - Urine ketone testing strips
 - Glucose tablets or gel
 - Cans of regular soda, juice and hard candies
 - Glucagon emergency kit
 - Current list of all medications (a prescription number may also help facilitate refills)
 - Copies of all relevant diagnoses, laboratory results and a list of all healthcare providers
 - Parental consent forms to treat in an emergency (if needed)
 - Medications taken on a regular basis
 - For those who take insulin: supplies such as syringes, insulin pen and pen needles, and, if appropriate, insulin pump supplies. Storage information may be found on the CDC website [110]. (Note, disposable pens may be helpful in emergency situations since the pen is not easily broken and the pens are ready at all times [58].)
 - Medication for nausea, vomiting and diarrhea
 - General supplies such as a first aid kit including an antibiotic cream, flash light and bottled water

Examples of food for an emergency kit for people with diabetes

- One large box of unopened crackers (saltines)
- One jar of peanut butter
- One small box of powdered milk (or milk that does not need refrigeration)
- One gallon of water per day per person for at least 1 week
- Two packages of cheese and crackers or one jar of soft cheese
- One package dry, unsweetened cereal or single serving boxes
- Six cans of sugar-free soda
- Six pack of canned fruit juice or sports drink
- Cans of tuna, salmon, chicken and nuts
- Can opener
- Keep all foods in a dry place

Data taken from [3,8,19,51,110].

Shelter personnel should be aware of the immediate needs of people with diabetes and have a plan for providing essential medications. Glucose monitors should be available at shelters and finger lancing devices and lancets should not be shared. If blood glucose monitors are shared, shelter personnel must practice appropriate disinfecting procedures to reduce the likelihood of transmitting infectious agents, such as hepatitis B. Shelters should, if possible, stock foods appropriate for people with diabetes and, in any case, personnel should be knowledgeable about the consequence of food choices. Disaster plans should also be aware of the location of shelters designated as special needs shelters for people who, for example, may be on dialysis, ventilators or who need feeding tubes.

■ Medication & supply issues

Necessary supplies, such as food, water, batteries, trauma and emergency kits and medication kits (including chronic disease medications), should be stockpiled. Many organizations, such as the Federal Emergency Management Agency, the American Red Cross, the American Medical Association, the ADA, and the American Public Health Association and American Association of Clinical Endocrinologists, recommend that people prepare for emergencies by storing food, water, flashlights and radios, as well as an extra reserve of their supplies and medications [6,7,51,58]. However, many medication plans only authorize 30 to 60 day supplies. Only 19% of patients have a 1-month supply of medications, and 38% reported that they would run out of their medications in 7 or less days [58].

Policies can both help and hinder medication availability. Laws to allow pharmacies to fill medications on an emergency basis have, in some cases, been established. However, other policies have hindered availability. For example, during Hurricane Katrina, there were regulations that mandated that all medications that were not in their original containers had to be taken away, resulting in many people going without their needed medications [3,8]. In view of the number of people with limited stockpiles of medication, policy changes that would allow patients to have a reserve of medications and supplies, such as a relaxation of public and private insurance limitations on the amount of medications and supplies, should be considered [15,58].

Retail leaders may assist in the mass post-disaster distribution of diabetes medications. Chain drug stores and wholesale clubs worked with public health agencies to distribute medical supplies during Hurricane Katrina. Many retail chains have trained pharmacy staff that run diabetes education programs (programs should include emergency preparedness in the education curriculum) and they could help in medication distribution and management [59,60,113].

Conclusion

Both man-made and natural disasters, can impact people with diabetes more severely than they impact others. The availability of medicine and supplies can be limited, particularly for those evacuated to shelters. People with diabetes, their caregivers, emergency responders and other healthcare providers do not always have sufficient information about diabetes and preparedness.

Public health preparedness plans might not address the needs of people with diabetes or other chronic conditions and this must be an essential part of any preparedness plan. Public/private partnerships are essential to develop policies, plans, and resources to assure the continuity of care for people with diabetes, before, during and after disasters.

Information resources

- Administration on aging: www.aoa.gov/AoARoot/Preparedness/index.aspx
- American Association of Clinical Endocrinologists (AAACE; www.aaace.com): www.powerofprevention.com/pub/DPcard_LoResp.pdf
- American Association of Diabetes Educators (AADE) tool kit for emergency preparedness: www.diabeteseducator.org/Disaster_Response_Toolkit.html
- American Diabetes Association (ADA) 341: www.diabetes.org; www.diabetes.org/living-with-diabetes/treatment-and-care/medication/tips-for-emergency-preparedness.html
- Associations of Schools of Public Health and CDC Public Health Preparedness and Response Core Competency Development project: www.asph.org/competency

- Centers for Disease Control and Prevention Clinician Outreach and Communication Activity (COCA): <http://emergency.cdc.gov/coca/>
- Centers for Disease Control and Prevention Coping with Disaster or Traumatic Event: www.bt.cdc.gov/disasters
- Centers for Disease Control and Prevention Division of Diabetes Translation funded Diabetes Prevention and Control Programs: www.cdc.gov/diabetes/news/docs/disasters.htm
- Centers for Disease Control and Prevention Public Health Readiness Certificate Program: www.cdc.gov/training/products/RN/index.html
- Hurricane Ike Impact Report, December 2008: www.disabilitypreparedness.gov
- Kentucky Diabetes Prevention and Control Program tool kit for emergency responders: <http://chfs.ky.gov/dph/info/dpqi/cd/diabetes.htm>
- National Association of County and City Health Officials (NACCHO): www.naccho.org/topics/emergency/index.cfm
- National Association of State Veterans Homes PREPARE: Disaster and Emergency Preparedness Training for the Long-Term Care Workforce: www.nasvh.org/committees/pdf/PREPARE_MWMTg_3-06.pdf

Disclaimer

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