Impact of natural and man-made disasters on people living with diabetes mellitus: a narrative review

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Abstract

Objective: Assess the direct impact of natural and man-made disasters on people living with diabetes (PLWD), emphasizing disrupted medical care access and adverse health outcomes.

Design:
Narrative review

Participants: People living with diabetes exposed to natural or man-made disasters.

Results: Natural and man-made disasters substantially disrupt medical systems, key services, and socioeconomic stability. As a result, PLWD are disproportionately affected because of reliance on continuous care, medications, and stable living conditions. Disruptions within healthcare infrastructure, medication access, and food security contribute to worsening glycaemic control, increased complications, and higher emergency healthcare utilization. Furthermore, socioeconomic inequalities and health disparities worsen these outcomes.

Conclusion: This evidence shows that people living with diabetes are highly vulnerable to the impacts of natural or manmade disasters. Therefore, strengthening disaster preparedness, enhancing the durability of the healthcare system, and implementing targeted interventions are vital to mitigate adverse health outcomes.

Key words:
Natural and man made disasters, people living with diabetes, access to medical care, adverse health outcomes

Introduction

The rising frequency and severity of natural disasters and the global increase in diabetes have made people living with diabetes more vulnerable (1)(2). Natural disasters result from the interplay of hazard exposure, population vulnerability, and limited adaptive capacity (3). In recent decades, climate-related events such as hurricanes, floods, bushfires, earthquakes, and heatwaves have intensified, disproportionately impacting low-income countries and Small Island Developing States, particularly in the Caribbean (4).

Many small islands cause very little climate pollution but face big climate risks. The same situation can be applied in some developing countries with low and very low income. This is because they are isolated, have weak buildings, depend on tourism, and rely on food and medicine from other places (4)(5). Their problems get worse because many people there have diabetes (1). This makes people with diabetes more at risk when disasters happen.

This review examines how natural and man-made disasters affect people with diabetes in areas at risk. It focuses on problems with getting healthcare, social factors, health effects, and what we can learn from disasters around the world. It points out what keeps people from getting care, what makes health problems worse, and offers ideas to help prepare for and respond to disasters.

Methods

This review examines how disaster responses address diabetes care, synthesizes evidence from peer-reviewed studies, global health reports, and policy documents, and cites key sources, including the World Health Organization (WHO), International Diabetes Federation (IDF), United Nations agencies, World Meteorological Organization (WMO) and national disaster frameworks. I selected literature on diabetes care during disasters, health system resilience, medication access, and clinical outcomes among Patient Living with Diabetes. I included case studies of major disasters and conflicts to provide contextual and comparative insights.

Results

1. Impact of Disasters on Health Systems and Infrastructure

Natural disasters cause extensive economic and structural damage worldwide, amounting to hundreds of billions of US dollars annually (5). In the Caribbean and other low-income countries, this devastation acutely undermines fragile healthcare systems (5). Hospitals, supply chains, and staff are frequently damaged or overwhelmed, threatening healthcare delivery.

These vulnerabilities result in critical disruptions to healthcare: the destruction of clinics, loss of refrigeration for insulin storage, interruption of laboratory services, and breakdown of electronic medical records. Such systemic failures reduce the ability to maintain continuity of care for chronic diseases such as diabetes (6)(7). Furthermore, disasters such as pandemics compound these challenges by adding pressure to already weakened systems (8).

2. Barriers to Healthcare Access

During disasters, essential lifelines, including electricity, water supply, transportation, and communication often severely disrupted (9). These failures directly impair diabetes management by limiting access to insulin, oral medications, monitoring devices, and healthcare professionals (10).

Medication shortages are usual due to interrupted supply chains and damaged distribution infrastructure (11). Patients frequently lose access to their prescriptions and medical documentation, further complicating continuity of care (11). Healthcare facilities may also experience staffing shortages, reducing capacity to deliver acute anchronic care services (11).

Historical disasters, including Hurricane Katrina (12) and the Great East Japan Earthquake (13), demonstrate prolonged healthcare system disruption lasting weeks to months, with significant impacts on chronic disease management.

3. Health Disparities and Vulnerability

Disasters exacerbate existing health and social inequities. Individuals with lower socioeconomic status, limited healthcare access, or pre-existing comorbidities experience disproportionately worse outcomes (14).

Ethnic minorities and marginalized populations are often the most affected due to structural inequalities in housing, healthcare access, and insurance coverage (14). In disaster settings, these groups frequently experience delayed access to emergency care, medication shortages, and reduced post-disaster recovery support (14).

The cumulative effect of poverty, limited resources, and high disease burden intensifies vulnerability among PLWD in low-resource settings (14).

4. Clinical and Metabolic Outcomes in Patients Living with Diabetes mellitus

Imagine facing a natural or man-made disaster as someone living with diabetes, in such times, controlling blood sugar becomes much harder: studies show that disasters lead to spikes in HbA1c, blood pressure, and cholesterol, causing dangerous swings in glucose levels (10)(13)(15).

Several mechanisms contribute to poor metabolic outcomes:

- Disruption of medication regimens, particularly insulin
- Irregular access to food and water
- Psychological stress and trauma
- Reduced physical activity or increased exertion without adequate nutrition

These factors increase the risk of both acute and chronic complications. Emergency department utilization rises due to diabetic ketoacidosis (DKA), hyperosmolar hyperglycaemic state (HHS), hypoglycemia, infections, and cardiovascular complications.

5. Lessons from Major Disasters

5.1 Hurricane Katrina (United States) (16)

Hurricane Katrina exposed major weaknesses in the management of chronic diseases during disasters (16). Key challenges included insulin shortages, loss of medical records, and inadequate preparedness in shelters. Diabetes was often underestimated in emergency planning, leading to insufficient supplies and delayed treatment.

Post-disaster consequences included poor glycaemic control, increased complications, and elevated morbidity and mortality (17). Coordination among healthcare providers, pharmaceutical companies, and humanitarian organizations improved results but was initially fragmented (16).

Key lessons include the need for:

- Strong disaster preparedness planning
- Reliable medication supply chains
- Patient education on emergency self-management
- Integration of chronic disease management into disaster response systems

5.2 Puerto Rico (Hurricane Maria) (18)

A study of diabetic patients before, during, and after Hurricane Maria showed significant deterioration in outcomes (18). Mortality increased dramatically, while glycaemic control and lipid levels remained poorly managed (18). Healthcare costs also rose post-disaster.

The findings show the long-term impact of infrastructure collapse on chronic disease outcomes and highlight the significance of continuous care systems and emergency preparedness frameworks aligned with American Diabetes Association (10) and Centre of Disease Control guidelines (19).

5.3 Japan (Great East Japan Earthquake) (13)

The 2011 earthquake exposed vulnerabilities in healthcare infrastructure, especially electricity, water, transport, and communication. Hospitals faced prolonged outages disrupting records, lab testing, and nutrition.

In response, Japan developed structured disaster preparedness frameworks (13), including the “Manual for Disaster Diabetes Care” and specialized response systems such as Diabetes Medical Assistance Teams (DiaMAT). These systems improved coordination, training, and deployment of diabetes-focused emergency care teams.

5.4 Australia (Bushfires, Floods, Heatwaves) (20)(21)(22)

Australia has shown uneven levels of disaster preparedness and response. This led to the creation of a diabetes-focused disaster guide (booklet-emergency-guide-services-councils-not-for-profit.pdf). In 2015, an Expert Reference Group developed resources to support people with diabetes, communities, and relevant authorities in managing diabetes during emergencies. They stressed individual emergency care plans, tools to help self-management after disasters, and widespread community education, given the large number of people affected.

Following this, the guide was first released in 2015 and later revised in 2021 and 2025 to incorporate updated evidence and best practices. Its overall goal is to reduce illness and death among people with diabetes during disasters while also reducing pressure on healthcare services. These strategies are interconnected and should be incorporated into routine health and disaster management systems. Doing so would support a sustainable approach to minimizing indirect morbidity and mortality among people with NCDs in disaster settings.

A study conducted by Ryan et al (2016), in Queensland, Australia, involved interviews and a focus group with disaster service providers (22). It showed a clear link between disaster impacts on health infrastructure and worsening health outcomes for people with NCDs. Participants identified a range of mitigation measures across all phases of the disaster cycle, including expanding telemedicine, improving coordination with medical suppliers, strengthening infrastructure and urban planning, ensuring power to evacuation centres, prioritizing the evacuation of high-risk individuals, and strengthening data collection and inter-agency information sharing (22).

These findings show that disaster service providers are key to improving health system resilience and reducing NCD-related risks. Embedding these approaches into routine planning, policy, and monitoring systems can strengthen disaster preparedness and response, support global disaster risk reduction efforts, and better safeguard at-risk populations throughout all disaster phases (22).

In 2018, Ryan et al conducted a study in Queensland, Australia, applied a multi-stage Delphi approach involving individuals with NCDs, disaster responders, coordinators, and government officials to identify and prioritize risk reduction strategies (23). A total of 31 strategies were identified across 12 areas of public health infrastructure.

Among the top priorities identified were assuring consistent access to safe water, followed by improvements in communication, sanitation, workforce capacity, and the availability of medical supplies. Key recommendations included equipping water treatment facilities with backup power, establishing dedicated primary healthcare hubs after disasters, and simplifying processes for accessing medications. For emergency planners, Australia's disaster experiences point out the importance of multi-level preparedness strategies, including individual emergency plans, community education, and national coordination (23).

Key lessons include guaranteeing continuous access to insulin, medications, monitoring equipment, food, water, and power supply. Emergency services must be prepared to detect and manage hypo- and hyperglycaemic emergencies.

5.5 Pakistani experience (24)

Diabetes care in humanitarian crises in Pakistan, especially following the 2005 Kashmir earthquake and the 2022 floods, has been significantly compromised by challenging terrain and a fragile medical system. A review of 197 sources published between 2000 and 2022, including peer-reviewed studies and reports from humanitarian organizations, highlights a lack of preparedness to manage chronic conditions such as diabetes in both emergency and routine contexts. Major gaps identified include disruptions within healthcare delivery and insufficient availability of critical medications, such as insulin. Furthermore, international response efforts have predominantly prioritized acute and infectious diseases, mental health, and high-risk groups, frequently overlooking diabetes care. The study stresses the need for national disaster preparedness plans to clearly incorporate non-communicable disease management, particularly diabetes, to remedy these ongoing deficiencies.

5.6. Syria and Iraq experiences (25)

This review demonstrates that political and military conflicts in Iraq (post-2003) and Syria (post-2011) have profoundly disrupted diabetes care by undermining medical systems, damaging infrastructure, and perpetuating instability. Mass displacement and refugee influxes have additionally strained already limited resources in both origin and host settings (25). Diabetes management, particularly for type 1 diabetes, has been largely overlooked, with severe insulin shortages and restricted availability to essential medications in both camp and non-camp environments. The privileging of communicable diseases over chronic conditions has created substantial gaps in care. The findings stress the urgent need to incorporate diabetes management into disaster preparedness and health system planning (25).

5.7. Pacific Region experiences (26)

A disaster is a significant disruptive event that results in injury, loss of life, or property damage and necessitates additional resources. As the global prevalence of diabetes continues to rise alongside the increasing occurrence of both natural and human-made disasters, people living with diabetes are particularly vulnerable, especially in regions such as the Pacific, where disasters are frequent. Addressing these risks requires coordinated preparedness and response efforts involving individuals, healthcare systems, governments, and multiple sectors (26).

Disasters can profoundly disrupt diabetes management by restricting access to essential needs, including shelter, electricity, communication, nutritious food, clean water, medications, healthcare services, and medical records. Such disruptions heighten the risk of poor glycemic control, infections, acute and chronic complications, cardiovascular events, and mortality. High-risk groups include children, older adults, individuals with type 1 diabetes, pregnant women, and those with pre-existing complications or frailty (26).

Even short-term disasters may lead to long-term health consequences, including deterioration in cardiometabolic health and elevated cardiovascular risk. Therefore, proactive planning and collaboration among key stakeholders, such as healthcare providers, emergency responders, transportation systems, media, and policymakers, are critical to minimizing adverse outcomes and ensuring continuity of care (26).

Pacific island nations face direct and harsh threats from climate change. Higher temperatures, altered rainfall, rising sea levels, and intensified extreme weather are already affecting key sectors, putting communities, ecosystems, and infrastructure at risk (42).

Despite the availability of scientific climate data, translating this information into practical planning and decision-making can be challenging, leading to underuse or misapplication. This can contribute to ineffective policies, missed opportunities for adaptation, and poorly informed actions (43).

The South Pacific confronts an existential threat from climate change, as rising sea levels, intensifying storms, and environmental degradation undermine livelihoods, economies, and the long-term habitability of islands such as Tuvalu, Kiribati, and Fiji. To tackle this crisis, immediate regional and global action is necessary (43).

5.8 Global Conflict Settings

Conflicts such as the Ukraine war and Ethiopia's Tigray conflict lay bare the deep suffering war inflicts on people with diabetes. As medical systems collapse almost overnight, lives are endangered by sudden insulin shortages, interrupted dialysis, and heartbreaking increases in preventable deaths (27) (28)(29)(30).

In reaction to these challenges, humanitarian organizations such as the International Diabetes Federation (IDF), NGOs, and pharmaceutical companies intervened to restore partial access to insulin and key medications. Nevertheless, long-term obstacles continue due to ongoing displacement, infrastructure destruction, and insecurity.

6. System-Level Challenges in Disaster Response

Common systemic issues across disasters include (31):
- Communication failures
- Lack of backup electronic medical record systems
- Food and water shortages
- Medication and insulin stock depletion
- Limited shelter preparedness
- Insufficient training among healthcare staff

Utilities such as electricity and water are critical for maintaining diabetes care infrastructure. Their disruption affects laboratory services, insulin storage, and hospital nutrition systems.

7. Clinical Management Challenges in Disasters (32)

Acute Metabolic Emergencies
Disasters increase the incidence of (33):
- Hypoglycaemia
- Hyperglycaemia
- Diabetic ketoacidosis (DKA)
- Hyperosmolar hyperglycaemic state (HHS)

Management priorities include preventing dehydration, maintaining insulin therapy, and ensuring access to glucose monitoring. Mild hyperglycaemia may be tolerated temporarily, while severe cases require emergency treatment.

Medication Considerations (34)
- Insulin remains essential, especially in type 1 diabetes
- GLP-1 receptor agonists and DPP-4 inhibitors are r elatively safe in emergencies
- Sulfonylureas increase hypoglycaemia risk and require dose adjustment
- Metformin may be contraindicated in dehydration or acute illness
- SGLT2 inhibitors carry dehydration and infection risks in disaster settings

8. Complications and Comorbidities

Disasters also increase the risk of (33):
- Cardiovascular disease (acute coronary syndrome, heart failure, stress cardiomyopathy)
- Hypertension (“disaster hypertension”)
- Cerebrovascular disease (stroke)
- Acute kidney injury (including crush syndrome)
- Deep vein thrombosis due to immobility
- Infections due to poor hygiene and overcrowding

Psychological stress further worsens glycaemic control and increases cardiovascular risk.

9. Mental Health Impacts (35)

Disasters are associated with high rates of:
- Post-traumatic stress disorder (PTSD)
- Depression
- Anxiety disorders
- Substance use disorders

Patients Living with Diabetes are particularly vulnerable due to stress related to medication access, food insecurity, and fear of disease complications (35). Mental health disturbances directly worsen glycaemic control and reduce self-management capacity (35).

10. Disaster Preparedness and Response Strategies (36)

Effective diabetes disaster preparedness includes:
- Individual emergency kits with insulin, medications, glucose monitoring tools, and food supplies
- Medication stockpiling for at least 1–2 weeks
- Emergency medical identification and documentation
- Backup communication systems
- Patient education on sick-day rules
- Training of healthcare workers in disaster diabetes management

Healthcare systems should ensure:
- Continuity of insulin supply chains
- Backup power and water systems
- Mobile diabetes response teams e.g., Diabetes Mobile Action Teams (DiaMAT)
- Integrated chronic disease management in disaster planning
- Multidisciplinary collaboration among physicians, nurses, pharmacists, dietitians, and technicians

Discussion

People living with diabetes in many disaster-prone regions encounter compounded vulnerabilities due to high baseline disease prevalence, fragile medical systems, and socioeconomic inequalities (36). Disasters worsen these challenges by disrupting access to healthcare, medication supply, and metabolic stability.

To reduce the heightened risks facing people with diabetes during disasters, immediate investment in structured preparedness systems is imperative (36). Policymakers, healthcare providers, and stakeholders need to urgently address health disparities, strengthen infrastructure robustness, and fully integrate chronic disease care into disaster planning to reduce preventable morbidity and mortality.

11.1. Theoretical Framework

This study uses an integrated approach that explicitly connects the Social Ecological Model (SEM)(37) and the Stress Process Model. SEM examines how individuals communicate with their environment at multiple levels: individual, interpersonal, organizational, community, and policy. The Stress Process Model explores how stressors, resources, and coping mechanisms impact health outcomes. By uniting these models, the study clarifies how multiple levels, from health system disruptions and social determinants (such as income or housing) to individual biological and behavioural responses, shape diabetes outcomes for people living with diabetes (PLWD) during and after disasters (37).

The Social Ecological Model (SEM) claims that health outcomes are determined by active interactions throughout multiple levels of influence. These include individual, interpersonal, organizational, community, and policy domains (37). During natural or man-made disasters, each level contributes to interruptions in diabetes management. At the individual level, a patient with Diabetes mellitus may have diminished capacity for self-management. Causes include stress, displacement, or loss of medical supplies (38). At the interpersonal level, reduced caregiver and family support may limit adherence to medication and dietary regimens (38). At the organizational level, damage to health services infrastructure, pharmacy closures, and interruptions in routine clinical services constrain entry to essential diabetes care (38). At the community level, food insecurity, unsafe water, and transportation barriers hinder disease management (38). At the policy level, variability in disaster preparedness planning, emergency response coordination, and the durability of the healthcare system determines the continuity of chronic disease services (38). Collectively, these structural disruptions compromise the continuity of diabetes care and self-management.

The Stress Process Model (39) explains that exposure to major life stressors affects health via three key mechanisms: psychological, behavioural, and physiological pathways (40). In natural or man-made disasters, primary stressors are direct exposures, life-threatening events, displacement, and injury (41), while secondary stressors include loss of income, medication shortages, and healthcare disruptions. Psychologically, stress increases anxiety, depression, and trauma-related symptoms (42). Physiologically, neuroendocrine activation, particularly increased cortisol levels, leads to hyperglycemia and metabolic imbalance (39). Behaviourally, stress may reduce therapy adherence, disturb dietary intake, decrease activity, and disrupt sleep (39). Collectively, these mechanisms worsen glycaemic control and increase the risk of acute diabetes complications (39).

The combination of the Social Ecological Model and the Stress Process Model delivers a comprehensive explanatory framework in which disaster-related structural disruptions at multiple system levels interact with individual stress responses to produce adverse diabetes outcomes (39). Specifically, natural and man-made disasters disrupt medical service systems and community resources, which, in turn, generate cascading stressors that affect psychological well-being and physiological regulation (39). The severity of these effects is not uniform and is modified by contextual and individual-level protective factors, including socioeconomic status, health literacy, baseline disease control, access to insurance, and the presence of disaster preparedness plans (39).

Accordingly, this study (39) conceptualizes diabetes outcomes during disasters as the product of a multilevel causal pathway: environmental shocks disrupt health care systems and social supports, which in turn activate stress-mediated biological and behavioural responses. These responses ultimately worsen glycemic control, increase acute complications (e.g., diabetic ketoacidosis and hypoglycemia), raise hospitalization rates, and increase mortality risk. This system informs both the selection of study variables and the examination of system-level and individual-level determinants of diabetes outcomes in disaster-affected populations.

Conclusion

Natural and man-made disasters pose a major threat to diabetes management globally, particularly in vulnerable regions. Disruptions in medical care systems, medication supply chains, and necessary services significantly worsen clinical outcomes for patients living with diabetes.

Strengthening health system infrastructure, ensuring medication continuity, enhancing disaster preparedness, and confronting social determinants of health are critical strategies to reduce adverse outcomes. Integrated, multidisciplinary, and system-wide approaches are essential to boost resilience plus safeguard patients living with diabetes during future disasters.

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