

# NURSING RESPONSES TO DISASTERS

## Managing Diabetes, Trauma, and Artificial Intelligence Technologies

Editor:

**Dr. Murat SEVEN**



**yaz**  
yayınları

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2025

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Editör: Öğr. Gör. Dr. Murat SEVEN

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*"Bu kitapta yer alan bölümlerde kullanılan kaynakların, görüşlerin, bulguların, sonuçların, tablo, şekil, resim ve her türlü içeriğin sorumluluğu yazar veya yazarlarına ait olup ulusal ve uluslararası telif haklarına konu olabilecek mali ve hukuki sorumluluk da yazarlara aittir."*

# **THE ROLE OF NURSES IN DISASTER MANAGEMENT**

**Kemal YARAN<sup>1</sup>**

**Hasan UYAR<sup>2</sup>**

**Mesut YILMAZ<sup>3</sup>**

## **1. INTRODUCTION**

Disasters are often sudden and devastating events that pose serious threats to the health, safety, and living conditions of a society. Natural disasters (e.g., earthquakes, floods, and hurricanes) and man-made disasters (e.g., war, terrorist attacks, and industrial accidents) can profoundly affect the physical and psychosocial integrity of individuals (World Health Organization [WHO], 2019). In this context, the role of health professionals, especially nurses, is critical in the disaster preparedness, response, recovery, and reconstruction phases. Nurses not only provide emergency health services in all phases of disaster management but also undertake multifaceted tasks such as preparation and planning, event management, assessment, guiding the recovery process of the community, providing

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psychosocial support, and protecting public health (International Council of Nurses [ICN], 2022).

Today, nurses' contributions to disaster management processes are shaped by their ability to use their theoretical knowledge and practical skills in the field of health in harmony with other health and social disciplines. Nurses' disaster preparedness includes not only interventions during disasters but also pre- and post-disaster recovery processes. Since Florence Nightingale, the contributions of nurses to disaster management have deepened, especially with their skills in assessment, prioritization, effective communication, collaboration, and critical thinking. The effectiveness of nurses in disasters depends on their experience, professional roles defined in disaster plans, level of disaster knowledge, and personal preparedness. Therefore, disaster knowledge should be kept up to date, and nurses should be competent in leadership, preparedness, and initial disaster response. (Fletcher, Reddin & Tait, 2022). The role of nurses in disasters is not limited to the provision of health services. Nurses also play an important role in long-term, post-disaster rehabilitation. Nurses' experiences related to disasters and the training they receive enable them to assume effective roles in disaster preparedness and response. These trainings enable nurses to be prepared for disasters, intervene consciously, and be more resilient to possible health crises (Pang, Chan & Cheng, 2009; Brewer et al., 2020).

## **2. DISASTER MANAGEMENT AND NURSING**

Disasters create multifaceted impacts with social, economic, and environmental dimensions, and it is not possible to eliminate these impacts completely. Therefore, effective disaster management is vital for ensuring the safety and sustainability of society. To minimize the damage caused by

disasters, the most widely accepted approach in disaster management is the "integrated disaster management" model. This model provides a management process covering all phases of disasters, planning effective interventions before, during, and after disasters, and ensuring that these processes are supported by technical, administrative, and legal regulations (Fletcher, Reddin & Tait, 2022). Integrated disaster management is based on a multidisciplinary and coordinated approach that covers preparation, response processes, and recovery activities before, during, and after disasters.

To reduce the effects of disasters and increase societal resilience against disasters, professionals and health workers must work effectively at all stages. In this context, nurses come to the forefront as essential health professionals who assume critical roles in disaster management. Nurses play an active role in pre-, during, and post-disaster processes. The holistic care approach, which is the basis of the nursing profession, also manifests itself in disaster management processes; nurses intervene in the physical, psychological, and social needs of individuals at all stages of health services (Njoku et al., 2020; Özgen & Bal, 2023; Şimşek & Gündüz, 2021).

The ability of nurses to provide effective interventions in disaster settings requires competent knowledge of disaster management, crisis management skills, and leadership capacity (Veenema, 2018). In effective disaster management, nurses ensure the efficient use of resources by performing triage, providing life-saving interventions, implementing infection control measures, and contributing to the rehabilitation process to minimize the long-term health effects caused by the disaster. Nurses' competence in disaster management creates a strong sense of readiness to help disaster victims and reduces their anxiety and hesitation (Emaliyawati et al., 2021; Songwathana & Timalsina, 2021; Setyawati et al., 2020). By providing quality



care and psychological support to affected communities, nurses competent in disaster management can increase public trust in healthcare providers and reduce post-disaster mortality and complications (Chegini et al., 2022). They can also comprehend disaster plans, communicate effectively in disaster areas, ensure decontamination and safety, solve ethical issues, and manage cases competently (Al Thobaity, Plummer & Williams, 2017).

### **3. THE ROLE OF NURSES IN DISASTER MANAGEMENT**

Disasters not only cause immediate damage but also have long-lasting social, psychological, and health consequences. In this context, nurses play a critical role in disaster management (Abdi et al., 2021). Historically, the role of nurses in disasters has been shaped by practices initiated by Florence Nightingale during the Crimean War. Florence Nightingale classified patients according to their needs by using environmental resources effectively during the war and applied the triage system effectively. These principles laid the foundation for nurses to be the main professionals providing healthcare services during disaster management (Al Harthi et al., 2020).

Disaster management is a multistage and dynamic process for the effective delivery of health services and is based on a framework that defines nurses' professional roles (Şimşek & Gündüz, 2021). The duties of nurses at every stage of disaster management overlap with the nursing process, which is a problem-solving approach to patient care. The nursing process consists of the identification, planning, implementation, and evaluation stages, which determine the roles of nurses at each stage of a disaster. Nurses' roles in providing health services, informing the community, providing psychosocial support, and restructuring the health system during disasters are critical for

mitigating the effects of disasters (Njoku et al., 2020; Özgen & Bal, 2023).

The World Health Organization (2009), addressing the roles of nurses in disasters from a broad perspective, states that these responsibilities cover areas such as risk reduction, disease prevention, health promotion, policy development and planning, ethical practice, education, and community care. In addition to caring for patients and their families, nurses have a duty to provide psychosocial support and specialized care to vulnerable groups during disasters (WHO, 2009). In 2009, the International Council of Nursing (ICN) and the World Health Organization (WHO) developed the Disaster Nursing Competencies Framework to further strengthen the role of nurses in disasters. This framework aims to standardize the competencies and training of nurses in disaster management. In addition, there is a growing consensus that nurses must acquire the necessary skills and knowledge to cope with the challenges they face in disaster management. Nurses should have the capacity to make critical decisions and direct responses as the first health personnel in disasters (Pang, Chan & Cheng, 2009).

Nurses' knowledge of disaster management is indispensable for nurses and health organizations in disaster areas. When nurses are highly qualified and have access to the necessary knowledge of disaster management, they can provide effective health education to the community on coping with disasters. Nurses' level of disaster knowledge may be adequate or inadequate depending on factors such as their level of education, previous experience, age, and personal development (Hayati, 2019).

### **3.1. The Role of Nurses in Disaster Preparedness**

Disaster preparedness is a fundamental element of disaster management. Nurses play an important role in disaster

preparedness. This role is critical for personal and institutional disaster preparation and the sustainability of health services. The contributions of nurses to the disaster preparedness process lead to effective results at both individual and societal levels (Al Harthi et al., 2020).

**Organizational and Social Contributions of Nurses:** Nurses can contribute to the preparation of disaster management plans for their families and the organizations they work for before disasters occur. In this process, nurses' knowledge plays an important role in planning the medical supplies and treatment needs of patients during disasters. In addition, critical decisions regarding the health services to be provided during a disaster are shaped by nurses' contributions. Nurses can participate in training activities on important issues, such as first aid training for volunteer teams, raising awareness of society against disasters, and triage during the disaster preparedness phase (Labrague et al., 2018; Özgen & Bal, 2023).

**Managerial Contributions to Disaster Preparedness:** Disaster preparedness is not only limited to the organization of health services but also includes urban planning and strengthening the physical infrastructure. Nurses in managerial positions assume a critical role in all arrangements to be made before, during, and after disasters, building reinforcements in hospitals, and creating disaster response plans (Fletcher et al., 2022). Nurses can undertake important tasks in hospitals, such as pre-disaster planning, triage, safe transfer of patients, and the organization of disaster drills. In addition, in the post-disaster period, nurses play an important role in monitoring the recovery process of patients and providing rehabilitation services to the community (Şimşek & Gündüz, 2021).

**Strategic Planning and Intervention Roles of Nurses:** The role of nurses in disaster preparedness has gained strategic

importance in recent years. The International Council of Nursing (ICN) has further clarified the roles of nurses in the disaster management process by establishing standards for disaster nurses. These standards clearly define nurses' responsibilities in disaster preparedness and response and strengthen the relationship between the nursing profession and disaster management (Pang, Chan & Cheng, 2009). Identifying the factors that cause nurses to feel inadequate in disaster preparedness and developing institutional plans to address these deficiencies are crucial. In this context, hospitals and other health institutions assume important responsibilities in terms of training programs and policy implementation for disaster preparedness (Özgen & Bal, 2023).

Disaster Drills and Training Programs: Supporting and investing in disaster preparedness training for nurses is crucial, as they are often the first responders in such situations. Their skills and expertise are invaluable in ensuring the safety and well-being of individuals and communities during a crisis. Integrating this training into curricula and professional development programs will contribute to the generation of nurses prepared for disasters. Drills and simulations further develop nurses' skills, ensuring their ability to think quickly and act effectively under pressure. Collaboration between prehospital and hospital teams, supported by shared training, creates a seamless response network that maximizes the use of available resources. Nurses equipped with disaster preparedness skills can extend their impact beyond the health-care system. They can play a vital role in leading community support programs aimed at educating individuals about basic preparedness and first-aid. All of these preparedness activities will enable nurses to be a safer and more effective force in disasters, while contributing to making communities more resilient and better prepared to cope with emergencies and disasters (Labrague et al., 2018). Drills conducted during the

disaster preparedness process are an important tool for ensuring that nurses are prepared to combat disasters. Realistic disaster drills should include skill training, such as disaster scenarios, first-aid training, life support training, and disaster planning. Such drills allow nurses to intervene more effectively in disasters.

### **3.2. The Role of Nurses During Disasters**

In disaster situations, nurses assume critical responsibilities in the provision of health services in health institutions where they work and in disaster areas. These responsibilities include a series of basic tasks, such as life-saving interventions, disease and injury prevention, triage, first aid, informing the community, and providing psychosocial support (Al Harthi et al., 2020; Özdemir & Sarıkamış, 2006). In the event of a disaster, the most important task for nurses is to reduce mortality and disability rates in the community by providing timely and effective intervention. In this context, critical processes such as lifesaving, first aid, and emergency response should be focused on to increase the probability of survival (ICN 2009). In addition, in special situations, such as chemical, biological, and radiological attacks, nurses may be involved in decontamination and other important tasks related to these processes (Taşkiran & Baykal, 2017).

In the initial phase of disasters, first responders usually comprise regional disaster management teams, medical personnel, and volunteers. One of the most critical tasks for nurses at this stage is the triage. With correct triage practices, nurses can determine the condition of the injured and provide priority interventions, thus saving many lives (Demirbaş, Sezer & Ergün, 2013; Özdemir & Sarıkamış, 2006). However, the importance of nurses specializing in triage during disasters increases even more, as a study found that 83% of the health personnel working in the emergency departments of university

hospitals in Ankara province did not know triage (Özdemir & Sarıkamış, 2006).

To provide effective intervention for injured people admitted to hospitals in disaster situations, hospitals must have disaster plans developed for possible disaster scenarios. It is also of great importance that these plans are regularly reviewed and drills for their implementation are conducted (Özdemir & Sarıkamış, 2006). Nurses play an active role in the safe transportation of patients to hospitals and triage and coordination of care processes during disasters (Al Harthi et al., 2020).

In disaster situations, the special care needs of children, older adults, and other vulnerable groups should be considered. Nurses should adopt a strategic approach to provide specialized care for these groups and work in coordination with health teams to provide patient care using available resources in the most effective way (Park & Kim, 2017). They also take an active role in tasks such as informing individuals in danger so that they can take the necessary precautions and evacuate patients in health institutions when a disaster warning is received (Al Harthi et al., 2020). This is an important skill that enables nurses to play critical roles in disaster response. Nurses need to improve their professional competencies during and after disasters, as well as during disaster preparation. This increases nurses' self-confidence and enables them to respond to disasters more effectively (Fletcher, Reddin & Tait, 2022).

### **3.3. The Role of Nurses in the Post-Disaster Process**

The post-disaster period is critical for healing the direct effects of a disaster and rebuilding social health. In this process, nurses contribute to rebuilding a healthy society by addressing physical health problems and psychological effects. The duties of nurses are not limited to physical health problems such as disabilities, injuries, and infections, but also require

comprehensive intervention for mental disorders such as posttraumatic stress disorder (PTSD) caused by the disaster (Akpınar & Ceran, 2020). In particular, in the treatment of psychological disorders such as posttraumatic stress disorder, nurses provide psychological support to disaster survivors, monitor the recovery process, and treat the symptoms of diseases (Said & Chiang, 2020).

In the post-disaster period, nurses adopt a multifaceted approach to protect society from the negative effects of disasters and accelerate the recovery process. In addition to meeting the health needs of individuals affected by the disaster, providing shelter, food, and ensuring environmental safety, nurses provide psychological support and guide society towards physical and mental recovery. This process contributes to the long-term recovery process and reduces the effects of trauma caused by the disaster (Al Thobaity, Plummer & Williams, 2017). With the decrease in the need for emergency care and the arrival of aid resources in disaster areas, nurses' duties are expanding. At this stage, nurses continue to provide sustainable health services to meet the health needs of the community, organize vaccination programs, conduct surveillance studies on health problems, and continue to monitor the community. In this context, nurses protect the community against future health threats by ensuring the sustainability of health services during the post-disaster period. (Akpınar & Ceran, 2020).

The contributions of nurses in the post-disaster period are not limited to treatment; they also contribute significantly to rehabilitation and reconstruction processes. Nurses monitor the health of society, take measures to prevent health problems, and carry out activities to provide sustainable health services. In this process, nurses adopt an approach to meet the general health needs of society and intervene in individual health problems.

#### **4. CONCLUSION**

Disaster management requires a multidisciplinary approach and coordinated work. Nurses play an important role at every stage of these processes with their professional knowledge and skills, as well as a holistic care approach. The main roles of nurses in disaster management extend to broader areas, such as increasing social resilience and strengthening individual and community rehabilitation processes, as well as increasing the effectiveness of health services in disaster preparedness, response, and post-disaster processes. Increasing nurses' disaster training is a fundamental element in strengthening social resilience to disasters. Strengthening their disaster preparedness and enabling them to respond competently significantly contribute to increasing social resilience.



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# **CRUSH SYNDROME AND NURSING CARE IN DISASTERS**

**Orhan POLAT<sup>1</sup>**

**Barış ÖZDERE<sup>2</sup>**

**Murat SEVEN<sup>3</sup>**

## **1. INTRODUCTION**

Annually, numerous individuals worldwide encounter natural disasters, such as earthquakes, hurricanes, floods, and landslides, as well as anthropogenic challenges, including occupational accidents, falls, traffic collisions, and conflicts. These events frequently result in significant injuries and, most critically, fatalities (M. S. Sever & Vanholder, 2013; Smith, 2022). Currently, approximately 800 million individuals reside in regions that are highly susceptible to severe cyclones and landslides, particularly in areas prone to earthquakes, such as Türkiye. This substantial population exposure may result in an increased incidence of injuries and fatalities during such disasters.

The extent and severity of these disasters are influenced by several factors, including the magnitude of the event,

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population density of the affected area, structural integrity of buildings within the settlements, level of preparedness among communities and individuals, and effectiveness of emergency response efforts (Bartels & Vanrooyen, 2012; Lall & Deichmann, 2009).

Large-scale and significant disasters often result in injuries and fatalities, with most deaths occurring due to severe trauma and entrapment immediately after the event. There is also a heightened risk of crush injuries and crush syndrome, which result from direct physical trauma to the body caused by an external force. Crush syndrome represents a severe systemic response characterized by muscle and permanent organ damage, which can lead to complications such as dysrhythmia, rhabdomyolysis, acute kidney injury, and infections. Data from previous disasters indicate that approximately 80% of trapped victims succumb rapidly to severe injuries, 10% experience crush injuries, and 10% sustain minor trauma. Among the 10% of patients who experience crush injuries, 40-70% subsequently develop crush syndrome. Healthcare professionals are at the forefront of evaluating and managing patients affected by natural and anthropogenic disasters, including severe earthquakes. Given the probability of encountering patients with crush injuries and crush syndrome, it is imperative that healthcare professionals possess a comprehensive understanding of the initial response and subsequent treatment protocols for these conditions (Bywaters, 1990; Michaelson, 1992; Oprita et al., 2024).

## **2. CRUSH SYNDROME**

Crush Syndrome occurs when one or more limbs are subjected to sudden and intense pressure. The pathophysiology of this condition begins with the destruction of muscle cells,

leading to the release of cellular contents into the systemic circulation. It is characterized by the destruction of muscle cells due to prolonged pressure on a large muscle mass. Consequently, substantial quantities of substances, including myoglobin, potassium, and phosphate, are released from the muscle cells into the bloodstream. This phenomenon can result in renal failure and may be fatal if not addressed promptly. It is frequently observed in scenarios such as natural disasters, construction mishaps, and vehicular accidents. The extent of tissue damage under pressure is contingent on the severity and duration of the trauma, and such damage can impair blood circulation and nerve function in the limbs, thereby posing a threat to vital organ functionality (Bakkaloğlu et al., 2024; Polat et al., 2024; Ramírez-Guerrero et al., 2024). In this syndrome, the exchange of nutrients and oxygen in tissues subjected to pressure is compromised, potentially resulting in tissue necrosis and functional impairment of the affected organs. Disruption of blood circulation leads to the accumulation of metabolic waste, and toxic substances may enter systemic circulation. When pressure on a limb is alleviated, the accumulated metabolic waste can disseminate throughout the body via the bloodstream, potentially causing severe health complications such as renal failure. Prolonged compression of the limbs or body parts can significantly impair organ function and pose life-threatening risks. The onset of this syndrome necessitates immediate intervention (Coşkun & Akın Turan, 2015; İşler et al., 2022).

## **2.1. Risk Factors**

The risk of developing crush syndrome is related to the type and severity of the trauma. Some risk factors include:

1. Natural disasters (such as earthquakes, landslides)

2. Accidents (such as construction accidents, traffic accidents)
3. Explosions and impact events
4. Prolonged periods of squeeze
5. Heavy objects falling on her/him
6. Excessive muscle exercise
7. Tight plaster casts or bandages
8. Trauma with severe edema
9. Intravenous (IV) administration of some drugs
10. Traumatic sports injuries
11. Surgical interventions
12. Prolonged immobilization after trauma
13. Severe burns
14. High doses of drugs or drug intoxication
15. Fractures
16. Venous insufficiency

## **2.2. Symptoms of Crush Syndrome**

*Pain and tenderness:* Intense pain and tenderness were observed in the affected area.

*Swelling:* Swelling due to edema or fluid accumulation in the injured area of the body.

*Dark urine:* Darkening and brown urine due to myoglobin excretion through the kidneys.

*Muscle weakness and movement limitation:* Muscle weakness or inability to move the affected area.



### **2.3. Diagnosis**

*Physical Examination:* A visual examination of the affected area was conducted, with assessments of the pulse and tenderness.

*Compartment Pressure Measurement:* Assessment of pressure in the affected compartment by direct pressure measurement.

*Blood Tests:* In context of crush syndrome, the assessment of elevated serum creatine kinase (CK) levels, renal function tests, and electrolyte balance is conducted.

*Imaging Methods:* Magnetic resonance imaging or ultrasonography can be used to assess the condition of the tissues and fluid accumulation.

*Neurovascular Assessment:* Assessment of the nerve and circulatory status in the affected area.

Early detection of signs and symptoms is extremely important for initiating appropriate treatments. The combination of the patient's history, physical examination and diagnostic tests helps to accurately recognize these two syndromes (Onan et al., 2024; Yavuz, 1999; Yıldırım et al., 2019).

### **3. RESPONSIBILITIES OF NURSES IN CRUSH SYNDROME**

Crush syndrome is a medical emergency characterized by severe complications that pose a significant threat to the patient's life. In the aftermath of such traumatic incidents, nurses' roles and responsibilities are paramount. Nurses are instrumental in facilitating early diagnosis and administering appropriate treatment, employing various methods to monitor

and assess the condition of patients after trauma (Hellaç, Yıldırım, & Gördes Aydoğdu, 2023; Mıhçı & Yılmaz, 2021).

### **3.1. Roles of Nurses in the Diagnostic Process**

Nurses play a crucial role in preserving life and improving patient outcomes by facilitating early diagnosis and implementing appropriate treatment (Coşkun & Akın Turan, 2015; İşler et al., 2022).

The diagnosis of crush syndrome is contingent on nurses' clinical observation. The patient's reported symptoms, findings from physical examinations, and details regarding the nature of the trauma contribute to the diagnostic process. Critical factors in this process include the nature and severity of the trauma experienced by the patient, their overall health status, and the presence of additional complications. Nurses listen to patients' narratives, conduct physical examinations, and assess diagnostic test results, such as medical imaging. Upon suspecting crush syndrome, nurses collaborate with the medical team to facilitate early diagnosis and ensure timely referral of the patient for appropriate treatment (Al et al., 2006; Harvey, 2001; Heron-Evans, 2006).

### **3.2. Roles and Responsibilities of Nurses in Monitoring and Evaluation**

Nurses employ various nursing methodologies to monitor and evaluate patients' posttraumatic conditions. These include:

- Continuous monitoring of vital signs (blood pressure, pulse, respiratory rate, body temperature)
- Evaluation of the results of blood tests and other laboratory examinations

- Assessment of circulation and sensation in the limbs
- Monitoring of urine output and renal function
- Monitoring of medical imaging tests such as electrocardiogram
- Assessment and control of the patient's pain level

In this process, they collaborate with physicians and other healthcare professionals to ensure that patients receive the optimal care.

### **3.3. Roles of Nurses in Emergency Patient Intervention**

Medical emergencies, such as crush syndrome, present life-threatening conditions that necessitate prompt and effective intervention. In response to such emergencies, nurses employ various strategies to preserve patients' lives and avert complications.

#### **3.3.1. Triage**

Rapid assessment and prioritization of the patient's condition in the emergency department.

#### **3.3.2. Patients' airway patency and respiratory support**

- Airway assessment is performed to ensure that the patients' airways are open.
- Oxygen therapy was used to support breathing, if necessary.
- Patients with breathing difficulties are taught methods to change their positions and encourage comfortable breathing.

### **3.3.3. Supporting Circulation**

- The patients' vital signs, including blood pressure, pulse, and heart rate, were continuously monitored.
- Ensuring IV access for rapid fluid therapy and medication administration.
- Fluid replacement is performed, and blood circulation is supported.
- Patients with blood loss receive appropriate blood products when blood transfusion is required.

### **3.3.4. Monitoring Urine Production**

Urine production is regularly monitored in patients with crush syndrome because of the risk of renal failure. In the event of a decrease or cessation of urine production, renal function should be continuously assessed to diagnose potential renal failure early, and an appropriate treatment plan should be developed.

## **3.4. Assessment of Patient Status with Monitoring and Monitoring Techniques**

Patient monitoring and follow-up are critical for the early detection of potential complications and timely interventions.

- Monitoring oxygen saturation: Continuous monitoring of cellular oxygenation using pulse oximetry was performed.
- Electrocardiography: Continuous monitoring of the heart rhythm is important, especially for electrolyte imbalances such as hyperkalemia.

### **3.5. Treatment Strategies**

#### **3.5.1. Pharmacologic Treatment Options and the Role of Nurses in Medication Management**

Pharmacological therapy plays an important role in the management of crush syndrome.

##### **Pharmacological Treatment Options**

- **Pain Management:** Severe pain associated with crush syndrome is attempted to be controlled using analgesics. Nurses regularly assess patients' pain levels and administer appropriate analgesics according to the doctor's instructions.
- **Anti-inflammatory and Antiedematous (edema-reducing) Therapy:** In case of crush syndrome, edema and inflammation are prevented. Anti-inflammatory drugs and anti-edema treatments can be used for this purpose.
- **Other Medications:** In Crush syndrome, drugs that increase urine output can be used to reduce the risk of kidney failure. Different medications may be preferred according to the condition and needs of the patients.

#### **3.5.2. The Role of Nurses in Medication Management**

Nurses carefully manage patients' pharmacological treatment. In this process:

- They ensure that medicines are administered at the right dose and time.
- The side effects of the drugs administered to patients should be monitored and reported appropriately.

- They organize patients' medication intake and ensure that medications are taken regularly.
- Safely manage processes such as storage, preparation and administration of medicines (LeMone et al., 2014; Polat et al., 2024).

### **3.5.3. Psycho-Social Support for Patients and Their Families**

Serious medical conditions such as crush syndrome can profoundly affect the lives of patients and their families. In such challenging times, nurses' emotional and psychosocial support for patients and families contributes to the treatment process. Nurses should adopt a sensitive approach to understand the mood and psychological needs of patients.

### **3.5.4. Empathic Communication and Caring**

Nurses communicate empathically with patients and try to understand their emotional condition. They listen to and support patients' concerns, fears, and emotional reactions. They respond to the emotional needs of patients and their families and promote trust and comfort.

### **3.5.5. Detailed Explanation of the Treatment and Rehabilitation Process**

Patients and their families are trained to explain the treatment and rehabilitation process in detail and to involve their relatives in treatment. By providing information about the planning of the treatment, the steps of the process, and the estimated process, patients are better prepared for the journey of recovery. Patients and families are trained on the exercises and movements to be performed during physical therapy and rehabilitation. It is ensured that they learn the correct techniques for exercises that should be performed during physical therapy sessions and at home.

### **3.5.6. Information and Drug Therapy Training**

They provide patients and their families with information about the disease process, treatment options, and drug therapy. They provide education on the effects, side effects, and correct use of the medications. They provide educational materials to support patients' compliance with treatment and the recovery process. They help patients and their families share their experiences and build strong support networks.

### **3.5.7. Nutrition and Lifestyle Changes**

Education on nutritional needs and lifestyle changes during the treatment process is also important. Guidance on healthy eating habits and lifestyle changes to prevent disease (LeMone et al., 2014).

Nurses provide the necessary education to patients and their families to make informed decisions and manage the disease during treatment and rehabilitation phases. They support the empowerment of patients and their families and their active participation in the healing process (Can, 1994; Wilkens et al., 2017).

## **3.6. Preventive Nursing Approach**

### **3.6.1. The Role of Nurses in the Prevention of Crush Syndrome**

Nurses play an important role in the prevention of crush syndrome. Nursing approaches, such as early detection, education, identification of risk factors, and implementation of preventive strategies, are crucial for preventing such medical emergencies.

### **3.6.2. Identification of Risk Factors**

Nurses conduct comprehensive assessments to identify situations in which patients and communities may be at risk.

Identification of risk factors, such as traumatic events, accidents, falls of heavy objects, and excessive muscle exercise, is important for raising awareness among patients and society and for planning preventive strategies.

### **3.6.3. Education and Awareness Raising**

Nurses inform patients and the community about the symptoms, risks, and preventive methods for crush syndrome. By organizing educational programs and awareness-raising campaigns, they raise awareness of how to prevent trauma and how to act in risky situations.

### **3.6.4. Implementation of Preventive Strategies**

They develop preventive strategies for at-risk individuals. For example, they provide training on the use of safety equipment for people performing heavy work. They take precautions during drug administration, such as using appropriate venous access methods and monitoring compartment pressure. They guide athletes and exercisers on the correct exercise techniques to avoid overloading.

Nurses primarily strive to protect the health of patients and society and prevent traumatic situations. The preventive nursing approach plays an important role in preventing medical emergencies while improving the quality of life of patients and the community (Aydin et al., 2003; Sever, 2001).

Early diagnosis, effective intervention, and continuous monitoring are essential for managing these diseases. Nurses play a central role at every stage of this process and undertake critical tasks, such as patient assessment, medication management, patient and family education, and pre- and post-operative care. The knowledge, experience, and familiarity of nurses with current approaches in this field may positively affect patient outcomes. Effective implementation of pharmacologic



and surgical treatment options requires a multidisciplinary healthcare team to work in harmony. A preventive nursing approach is vital for preventing such emergencies. Nurses develop preventive strategies by identifying risk factors, raising awareness by educating patients and the community, and contributing to efforts to prevent traumatic events. Within the team, nurses have a critical role in responding to the physical and psychological needs of patients (Apaydin, 2002; Carpetino, 1999; Yıldız, 2000).

#### **4. CONCLUSION**

Crush syndrome is a critical clinical condition that necessitates immediate and comprehensive intervention, particularly following natural disasters and large-scale traumatic events. Prompt identification of this syndrome, coupled with swift and effective intervention, is the primary determinant of patient outcomes. Nurses, as frontline healthcare professionals in disaster scenarios, play an essential role in a multidisciplinary approach. Their responsibilities extend beyond physiological monitoring and treatment practices to include the provision of psychosocial support and educational activities for patients and their families.

Effective management of crush syndrome is contingent upon the nurse's proficiency in executing clinical responsibilities, including early diagnostic capabilities, vigilant monitoring of vital signs, medication administration, and maintenance of nutritional and fluid equilibrium. Furthermore, nursing strategies that consider patients' psychological conditions and facilitate empathic communication significantly enhance the treatment process. Additionally, preventive nursing strategies are crucial for disaster preparedness, risk factor

identification, and enhancing health literacy within the community.

In conclusion, nursing care plays a crucial role in managing emergencies with high mortality risk, such as crush syndrome. It significantly impacts both the individual and societal levels through early diagnosis, effective treatment, follow-up, patient education, and preventive measures. In this context, it is imperative to enhance disaster nursing, adequately prepare nurses for disaster scenarios, and provide them with the current information.

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# **DIABETES MELLITUS MANAGEMENT AND NURSING IN DISASTER RISK PROCESSES**

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## **1. INTRODUCTION**

According to the Turkish Language Association (TLA), a "disaster" is characterized by destruction resulting from various natural phenomena or conditions, which subsequently leads to adverse outcomes (TLA, 2025). The United Nations International Strategy for Disaster Reduction (UNISDR) defines a disaster as a substantial disruption in the functioning of a community or society, resulting in significant human, material, economic, or environmental losses that exceed the capacity of the affected community or society to manage with its own resources (UNISDR). Similarly, the World Health Organization (WHO) describes a disaster as a sudden and large-scale event that affects the lives and well-being of a considerable number of individuals or a significant portion of the population, necessitating multi-sectoral assistance. (WHO, 2017).

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Throughout history, disasters have posed substantial challenges to civilizations. The livelihoods and possessions of individuals have been instantly devastated by these catastrophic events. Despite considerable advancements in the sociological, economic, technological, and scientific fields, disasters persist globally, affecting populations worldwide (Eryılmaz, Tezel, & Ulusoy, 2021).

Disasters are classified into natural and anthropogenic categories. Natural disasters encompass both gradual and abrupt events and are further divided into slow-onset natural disasters, such as severe cold, drought, and famine, and sudden-onset natural disasters, including earthquakes, floods, landslides, rockfalls, avalanches, storms, tornadoes, volcanic eruptions, and fires. Human-induced disasters comprise nuclear, biological, and chemical accidents, as well as transportation and industrial accidents and incidents arising from overcrowding, migration, and displacement (AFAD).

The disaster risk management process consists of two primary phases: pre- and post-disaster. The pre-disaster phase includes mitigation, prevention, and disaster preparedness activities. The post-disaster phase involves response, recovery and reconstruction (Işık et al., 2012; Varol & Kaya, 2018). In the contemporary context, enhancing awareness and strengthening education in disaster risk management are of utmost importance. (Bulut, 2023; Mızrak, 2018).

Individuals with diabetes are more vulnerable than their healthy counterparts in disaster scenarios, necessitating careful management of their care (Gohardehi, Seyedin, & Moslehi, 2020). A study investigating the effects of hurricanes on diabetes self-management and outcomes underscored the challenges posed by limited access to balanced nutrition and medications (Travia et al., 2021). Post-disaster, individuals with diabetes face numerous



adversities, including malnutrition, insufficient access to potable water, adverse climatic conditions, physical and psychological stress, trauma, infections, and difficulties in obtaining medications, all of which exacerbate their conditions (Gohardehi et al., 2020). Understanding the impact of disasters on individuals with diabetes is essential for preparing these patients for such scenarios, managing effective response and recovery processes, and mitigating the potential consequences of these events (Colf & Mcaleavy, 2024). Research indicates that individuals with diabetes constitute a significant demographic affected by disasters (Bell, Horowitz, Iwashyna, & Heyn, 2020; Forouhi & Wareham, 2019; Gohardehi et al., 2020). This section explores the roles of diabetes management, care, and nursing within the context of disaster risk processes.

## **2. DIABETUS MELLITUS**

Diabetes Mellitus (DM) is a chronic metabolic condition characterized by elevated blood glucose levels due to impaired insulin secretion, insulin function, or a combination of both (TURKDIAB, 2021). Diabetes mellitus is characterized by disturbances in the metabolism of carbohydrates, proteins, and fats, alterations in vascular structure, and acceleration of atherosclerosis. This results in the development of both macrovascular and microvascular complications (Birol, Olgun, & Çelik, 2021). In managing this disease, it is essential to provide patients with continuous education to reduce the risk of both acute and chronic complications while also acknowledging the need for ongoing medical care (TEMD, 2022). According to the 2025 report by the International Diabetes Federation (IDF), the global prevalence of diabetes is 11.1%. According to data from the International Diabetes Federation (IDF), the global population of individuals with diabetes is projected to reach 8.1 billion in 2024,

with an anticipated increase of 9.7 billion by 2050 (IDF, 2025). There is substantial evidence indicating that the COVID-19 pandemic has exerted direct and indirect adverse effects on individuals with diabetes. The recurrent imposition of lockdowns and public health measures during the pandemic markedly limited access to routine diabetes care, complicating the process of new diagnoses and negatively impacting self-management, regular follow-ups, and the availability of medications. Additionally, these measures have altered lifestyle behavior. Research indicates that short-term delays experienced during the pandemic are associated with adverse microvascular, macrovascular, and mortality outcomes in individuals with diabetes (Khunti et al., 2022).

In the context of natural disasters, delivering care to individuals with diabetes and other chronic conditions is significantly hindered by the lack of cohesive management strategies, emergence of physical and psychosocial health issues, challenges related to health literacy and behaviors, and obstacles in the provision of healthcare services (Ghazanchaei, Aghazadeh-Attari, Mohebbi, Allahbakhshi, & Khorasani-Zavareh, 2023). Research indicates that elderly individuals who experienced traumatic stress as a result of the hurricane exhibit an elevated risk of developing diabetes and other chronic diseases four years post-hurricane, in comparison to their counterparts (Sands, Do, Du, & Pruchno, 2022). A meta-analysis determined that the prevalence of diabetes in communities affected by disasters was 13.56%. The findings indicate that the prevalence of diabetes is higher among disaster survivors than in the general population (Gohardehi et al., 2020). In 2011, prompted by the Great East Japan Earthquake, the Japan Diabetes Association established Guidelines for Disaster Diabetes Care. This comprehensive disaster guide provides an in-depth examination of the roles of healthcare providers in managing diabetes during disasters. It also

addresses a carefully curated range of topics, including personalized emergency medical response measures for various types of diabetes and treatments, and disaster preparedness for individuals with diabetes. This guide serves as a crucial resource for managing diabetes during disasters (Satoh et al., 2019).

### **3. PROCESSES FOR DIABETES CARE BEFORE DISASTER**

Healthcare institutions should formulate diabetes care guidelines specifically designed for disaster scenarios and ensure their effective dissemination to relevant stakeholders. An illustrative example of such an initiative is the Disaster Diabetes Care Guidelines developed in Japan. In this context, healthcare professionals engaged in disaster response can contribute their expertise and experience in diabetes management in disaster situations, potentially increasing awareness of this issue. During the pre-disaster preparation phase, developing training scenarios focused on disaster-related diabetes management is advisable. Additionally, certification programs on disaster diabetes should be organized. Promoting disaster preparedness among individuals with diabetes is a critical concern. Patient education programs should encourage individuals with diabetes to maintain supplementary supplies of insulin formulations, insulin self-injection devices, blood glucose self-monitoring devices, and oral hypoglycemic agents in addition to their regular stocks. Individuals are encouraged to consistently have diabetes management guidelines and a drug profile book on hand, which comprehensively detail their personalized treatment plans (Satoh et al., 2019).

It is advisable to bolster the disaster preparedness and resilience of the diabetes care system. In the context of disaster preparedness, ensuring the availability of insulin, antidiabetic

medications, and other necessary medical supplies for individuals with diabetes is essential. To effectively support individuals with diabetes in emergency health units and evacuation centers, it is advisable to implement telehealth services for insulin therapy and foster enhanced collaboration among relevant agencies. Assigning healthcare professionals with specialized knowledge in diabetes care to regions impacted by disasters could enhance the effectiveness of addressing the needs of individuals with diabetes (Satoh et al., 2019).

To effectively equip individuals with diabetes for disaster situations, it is crucial to offer training on the use of mobile devices during emergencies and the assembly of diabetes emergency kits (İşleker, Çelik, & Bayraktaroğlu, 2023; Satoh et al., 2019). Individuals diagnosed with diabetes should be trained to assemble emergency diabetes kits for disaster preparedness. These training programs should also provide information on the essential materials to be included in such emergency kits. For individuals managing diabetes, it is essential to ensure that emergency diabetes supplies are stored in an easily accessible location (İşleker et al., 2023). An emergency kit for individuals with diabetes should comprise essential medical supplies and medications necessary for the condition (İşleker et al., 2023). Individuals with diabetes experience immune system impairments, resulting in increased susceptibility to infections. This results in a more severe progression of infections within this cohort and an increased rate of hospitalization among individuals with diabetes (Tarkun, Sargin, & Salman). Immunization practices are critically important for individuals with diabetes to maintain their health. In addition to reducing the risk of infection, seasonal influenza vaccination is an effective strategy for preventing severe complications (Holt, Cockram, Ma, & Luk, 2024). Educating patients with diabetes about vaccinations and the importance of ongoing vaccine follow-up is crucial for

enhancing their quality of life and ensuring their preparedness for emergency situations (Holt et al., 2024; Unnikrishnan & Misra, 2020).

<b>Recommended vaccination schedule for people with diabetes</b>		
<b>Vaccine</b>	<b>Age Group</b>	<b>Frequency</b>
Hepatitis B	Unvaccinated adults aged 18 to 59 years with diabetes	A 2 or 3-dose hepatitis B vaccine is recommended
	Adults aged 60 years and older with diabetes and unvaccinated adults	A 3-dose hepatitis B vaccine is recommended
Flu	All persons 6 months and older	Annual vaccination recommended
Pnömonokok	Children before the age of 2	Conjugated Pneumococcal Vaccine 13 vaccine recommended
	People with diabetes between the ages of 2-64	23% valent pneumococcal polysaccharide vaccine is recommended and a reminder dose is needed after age 65
Human papillomavirus	26 years old preferably before	Three doses over 6 months
Tetanus, diphtheria and whooping cough		A single dose every 10 years followed by a repeat dose
Zoster	50 years and older	Two doses, 2-6 months apart

The recommended vaccination schedule for people with diabetes is based on many national and international sources (ADA, 2020; Holt, Cockram, Ma, & Luk, 2024; Husein & Chetty, 2018; Tarkun, Sargın, & Salman; TEMD, 2022; TÜRKDİAB, 2023; Unnikrishnan & Misra, 2020).

Materials to be included in a Diabetes Emergency Kit (İşleker, Çelik, & Bayraktaroğlu, 2023).

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**Medical Supplies**

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Insulin and antidiabetic drugs  
Adequate insulin injectors or insulin pens  
Blood glucose test strips, finger pricking device (lancet and similar), glucometer and spare batteries  
Waste bin  
Urine or blood ketone measurement strips  
Hypoglycemia (low blood sugar) kit: Simple sugar, fruit juice, glucose tablets, Glucagon emergency kit  
Freezer bag containing sufficient quantities of refreezable, cold packs  
Cotton, paper tissues, wet wipes  
A pen and notebook to record the blood glucose measurement

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**Other Emergency Supplies**

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Flashlight, spare batteries  
Lighters and candles  
Radio  
First aid kit  
Whistle  
Spare socks  
Protective clothing

## **4. IMPORTANT ISSUES FOR PEOPLE WITH DIABETES IN THE AFTERMATH OF A DISASTER**

### **4.1. Medical Issues for Individuals with Diabetes for Post-Disaster**

Following a disaster, individuals with diabetes are particularly vulnerable (Allweiss & Albright, 2011; Ryan et al., 2015). Research conducted following disasters in Japan, Turkey and the United States has revealed that individuals with diabetes frequently experience deteriorating blood glucose control and a reduced quality of life, in addition to an elevated risk of necessitating urgent medical intervention (Inui et al., 1998; Lee et al., 2016; Şengül et al., 2004; Tanaka et al., 2014). In the aftermath of a disaster, disruptions in diabetes care manifest as insufficient blood glucose monitoring, inadequate medical nutrition, constraints on physical activity, obstacles in acquiring medication, challenges in safely storing insulin due to power failures, and complications in renewing prescriptions. Natural

disasters increase the likelihood of individuals with diabetes developing medical complications. This heightened risk can lead to the exacerbation of disease symptoms in the days following the disaster, thereby increasing susceptibility to potential morbidity or mortality (Allweiss & Albright, 2011; Ryan et al., 2015). Post-disaster scenarios can worsen diabetes symptoms due to interruptions in medical monitoring and care, limited access to nutritious food and potable water, and heightened exposure to extreme environmental temperatures, whether excessively cold or hot (Ryan et al., 2015). The provision and distribution of insulin, antidiabetic medications, and blood glucose meters to disaster-affected areas are essential for managing patients with diabetes in the disaster aftermath (Satoh et al., 2019).

#### **4.2. Diabetes and Infection After Disaster**

Patients with diabetes are at an elevated risk of infection due to several contributing factors. These include a weakened immune response, compromised antioxidant defense, and reduced production of inflammatory cytokines. Additionally, dysfunction within the gastrointestinal system, along with both microvascular and macrovascular complications inherent to diabetes, further contribute to this heightened susceptibility. The frequent necessity for invasive medical procedures also plays a significant role in increasing this risk (Apaydin, 2021; Casqueiro, Casqueiro, & Alves, 2012). In individuals with diabetes, a notable share of mortality, disease burden, and hospital admissions is linked to infections such as pneumonia, influenza, and hepatitis B. Several studies have shown that individuals with diabetes are hospitalized due to infection and die as a result of infection or its related complications (Apaydin, 2021; Nichol, 2006). Following disasters, the risk of infection increases among individuals. In the aftermath of a disaster, waterborne infectious diseases, including cholera, leptospirosis, hepatitis, bacillary dysentery, and typhoid fever, are frequently observed in the affected population. In the

aftermath of disasters, large gatherings of people can facilitate the transmission of infectious diseases such as pneumonia, measles, bacterial meningitis, tuberculosis, influenza, and tetanus. Following disasters, there is a potential for the emergence of vector-borne infectious diseases, including malaria, dengue fever, encephalitis, and yellow fever. Other significant infections include urinary tract infections, skin and soft tissue infections, and diabetic foot infections (Canbulat, 2023; Chamberlain et al., 2022; Holt et al., 2024). Ensuring the protection of individuals with diabetes from the risk of infection is of utmost importance. Public health interventions, such as enhancing personal hygiene, avoiding crowded settings, and utilizing masks, can effectively mitigate the risk of transmission of certain infections. Enhancing awareness and adherence to these preventive measures is crucial (Critchley et al., 2018; Holt et al., 2024; Jefferson et al., 2023). Both national and international guidelines advocate for the routine immunization of individuals with diabetes, as certain prevalent infections can be effectively prevented by vaccination. Vaccination serves as an efficacious method for both diminishing the probability of contracting an infection and averting severe complications (ADA, 2020; Elsayed et al., 2023; Husein & Chetty, 2018b; Modin et al., 2020; Tarkun et al.; TEMD, 2022).

#### **4.3. Nutrition Problems of Individuals with Diabetes for Post-Disaster**

Nutrition is pivotal in the management of diabetes, particularly in preventing and delaying complications. Considering the dietary patterns of individuals, it is recommended to structure food consumption into primary meals and additional smaller meals (TÜRKDİAB, 2023). Three days after the February 2023 Kahramanmaraş earthquake in Turkey, a number of participants indicated that they overlooked disease management as they focused on addressing their nutritional requirements (Doğan & Tamer, 2024). In the aftermath of the earthquake, the



fundamental nutritional requirements of the affected individuals included the provision of hot meals and maintenance of food hygiene (Aldemir, 2023). In the aftermath of disasters, a significant challenge is the difficulty in accessing clean drinking water and food supply. The provision of clean, safe, and nutritious food is a significant concern for individuals with diabetes after a disaster. In the aftermath of a disaster, food insufficiency can exacerbate diabetes-related complications such as hypoglycemia due to malnutrition. This is particularly concerning for disaster survivors with diabetes, who have specific nutritional requirements (Aldemir, 2023; Evert et al., 2014; TÜRKDIAB, 2023). It is imperative to establish food management units within disaster centers to effectively identify, procure, and safely deliver the nutritional requirements of individuals affected by disasters. Pre-packaged foods provide an immediate and effective response to disasters. However, it is essential to establish comprehensive, long-term nutritional strategies and action plans for large-scale events (Aldemir, 2023).

#### **4.4. Diabetes Wound Healing in Disasters**

During disasters, individuals may sustain severe injuries, including soft tissue contusions, sprains, neurovascular injuries, peripheral nerve damage, fractures, brain trauma, amputations, spinal cord injuries, and burns (Bartels & Vanrooyen, 2012; Khan, Amatya, Gosney, Rathore, & Burkle, 2015; Long, Liang, & Gottlieb, 2023). Wound healing encompasses several interconnected biological mechanisms, including hemostasis, inflammation, epithelial tissue formation, and remodeling. In individuals with diabetes, essential processes such as endothelial cell proliferation, angiogenesis, and collagen synthesis, which are vital for effective wound healing, may be altered, potentially leading to a delay in the healing process. Moreover, hyperglycemia induced by diabetes adversely affects leukocyte function, resulting in insufficient neutrophil and macrophage

migration to the wound site. This hyperglycemic condition may extend the wound-healing process by hindering collagen synthesis (Ko, Sculean, & Graves, 2021; Okonkwo & Dipietro, 2017; Wilkinson & Hardman, 2020). Injuries sustained during disasters frequently elevate the risk of infection. Factors such as wound contamination, tissue loss, and inadequate or delayed cleaning and debridement can negatively impact the wound-healing process (Shu et al., 2024). In individuals with diabetes affected by disasters, these processes significantly impede wound healing. Wound care is a significant concern for these patients.

## **5. ROLES OF NURSES IN DIABETES MANAGEMENT IN DISASTERS**

Disaster nursing seeks to identify individuals affected at all stages of disaster events by actively engaging at every level of disaster management. It aims to deliver the highest quality of care services by utilizing nursing clinical knowledge, skills, and activities to mitigate health and life-threatening risks (Firouzkouhi, Kako, Abdollahimohammad, Balouchi, & Farzi, 2021; Şimşek & Gündüz, 2021). The clinical competencies that nurses demonstrate in disaster scenarios encompass technical proficiency, the adept application of nursing techniques utilizing specialized equipment, execution of physical examinations, clinical decision-making capabilities, triage and trauma management expertise, adaptability, and the ability to undertake nontraditional roles (Al Thobaity, Plummer, Innes, & Copnell, 2015; Firouzkouhi, Zargham-Boroujeni, & Abdollahimohammad, 2018). The International Council of Nursing (ICN) delineates disaster nursing competencies across eight domains. These domains encompass preparedness and planning, communication, incident management systems, safety and security, assessment, response, recovery, and legal and ethical

considerations (ICN, 2019). During pre-disaster periods, it is imperative for nurses, individuals with diabetes, and their families or caregivers to prepare an emergency diabetes kit, whether at home or in the workplace. This bag should contain a sufficient supply of diabetes medications, medical supplies, water, food, and other essential items. Patients and individuals living with or caring for them are advised to verify the expiration dates of medications and food items in the bag biannually (TEMD, 2022). It is imperative for nurses to implement strategies to safeguard individuals with diabetes from acute complications, such as hypoglycemia, hyperglycemia, and diabetic ketoacidosis, particularly in the aftermath of disasters. In this regard, comprehensive educational materials addressing disease management issues, including nutrition, weight management, and blood glucose monitoring should be developed. Furthermore, it is essential to organize disaster education programs in collaboration with other stakeholders (Yel & Karadakovan, 2023).

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# **ARTIFICIAL INTELLIGENCE SOLUTIONS FOR HEALTH SERVICES IN DISASTERS**

**Murat SEVEN<sup>1</sup>**

**Ömer TAŞCI<sup>2</sup>**

**Bariş ÖZDERE<sup>3</sup>**

## **1. INTRODUCTION**

The Law on the Organization and Duties of the Disaster and Emergency Management Presidency defines a disaster as a "natural, technological, or human-induced event that results in physical, economic, and social losses for the entirety or specific segments of society, thereby halting or disrupting normal life and human activities" (Prime Ministry General Directorate of Legislation Development and Publication, 2009). In recent years, there has been a marked increase in the frequency, magnitude, and economic impact of disasters, globally. This trend has led to significant adverse effects on human health, the environment, and the economy (Fant & Adelman, 2022; Kao et al., 2023). According to data from EM-DAT (The International Disaster Database (EM-DAT), over the past 25 years (2000-2025), a total of 16,194 disasters have been recorded, affecting 2.9 billion individuals and resulting in the loss of 1,797,712 lives (EM-DAT,

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2025). In the context of contemporary and multifaceted disasters, including both natural and the increasing incidence of anthropogenic disasters, traditional methods of emergency response often prove inadequate (Ali Maher, Panu Napodano, & Bellizzi, 2024). Contemporary emergencies are characterized by multifaceted complexities and novel contexts that extend beyond the mere application of lessons derived from previous disasters. The conventional linear model of disaster management, which emphasizes distinct phases, such as preparedness, response, and recovery, is increasingly subject to scrutiny. Instead, there is growing recognition of the necessity for a more integrated and adaptive approach that concurrently addresses these three phases (Bellizzi et al., 2020, 2023).

Through the application of advanced algorithms, artificial intelligence (AI) can identify intricate patterns within extensive healthcare datasets, thereby enhancing clinical practice. Additionally, AI systems possess the capacity for learning and self-correction, which allows for improved accuracy through feedback mechanisms. AI supports healthcare professionals by providing access to the most recent medical knowledge derived from scientific journals, textbooks, and clinical experience, thereby ensuring optimal patient care. Furthermore, AI systems play a crucial role in minimizing diagnostic and treatment errors that are inherent in human clinical practice. These systems also extract valuable information from large patient populations, offering real-time inferences for health risk warnings and predictions of health outcomes (Alkahlout & Ahmad, 2023; Eppes, Garcia, & Grobman, 2012; Jiang et al., 2017; Neill, 2013; Patel et al., 2009). In rapidly evolving and complex situations, such as disasters, data collection and analysis, as well as immediate decision-making, can be particularly challenging. The integration of AI into disaster management protocols presents a promising solution to the challenges encountered in these high-

risk scenarios (Ali Maher et al., 2024). AI technologies facilitate the development of more effective and cost-efficient response strategies by analyzing historical disaster data and predicting risks. These technologies enhance the capacity of societies to adapt to and recover from disasters (Fant & Adelman, 2022). Artificial intelligence offers different advantages and applications in various disaster scenarios. Some of these advantages and applications are presented below.

## **2. ARTIFICIAL INTELLIGENCE AND CRIME SCENE EVACUATION**

In the planning of large-scale buildings, it is essential to preemptively assess evacuation routes for potential disaster scenarios to facilitate the development of effective evacuation plans. Nonetheless, these routes may become compromised owing to obstructions or overcrowding. To address this issue, an adaptive evacuation guidance system incorporating area-wide monitoring sensors and intelligent guidance signs was proposed. The sensors are tasked with monitoring evacuation pathways, whereas the signs provide dynamic guidance to evacuees in a coordinated manner. A critical component of this guidance system is the crowd behavior recognition subsystem, which utilizes machine learning to monitor evacuee flows and detect anomalies (Horii, 2020). The implementation of these artificial intelligence systems enables the monitoring of congested areas and facilitates strategic planning of health services.

## **3. REMOTE TRIAGE WITH ARTIFICIAL INTELLIGENCE**

Triage is a classification system employed to prioritize clinical interventions based on the severity of injuries among

patients requiring first aid with the objective of enhancing survival rates through effective treatment delivery. Among the various triage methodologies, the most prevalent involves on-site practitioners assessing numerous trauma patients to prioritize treatment during mass casualty incidents such as natural disasters, fires, acts of terrorism, or battlefield scenarios (Iserson & Moskop, 2007). For instance, an analysis of 4,596 battlefield casualties from 2001 to 2011 revealed that 87.3% of all injury-related fatalities occurred before triage, with 24.3% of these injuries deemed potentially survivable (Eastridge et al., 2012).

While triage conducted by healthcare professionals is considered the safest approach, decision-making time may be extended when personnel numbers are limited and the number of injured individuals is high. Consequently, there is a need to develop algorithms capable of accurately classifying trauma patients within a constrained timeframe independent of medical personnel. A data-driven artificial intelligence model for remote triage in prehospital settings was developed. Researchers have proposed the Simplified Consciousness Score (SCS) as an alternative to the Glasgow Coma Scale (GCS) for remote monitoring. They developed machine-learning algorithms, including logistic regression, random forest, and deep neural networks, to predict survival based on vital signs and SCS. The deep neural network model demonstrated superior performance, comparable to that of conventional systems. The level of consciousness (GCS or SCS) emerged as the most significant feature for survival prediction across all the models. This study highlighted the potential for remote triage using wearable devices, which could reduce triage time and potentially enhance survival rates during mass casualty events (Kim et al., 2018).

#### **4. ARTIFICIAL INTELLIGENCE AND COVID-19**

While most natural disasters, such as earthquakes, cyclones, and tsunamis, predominantly have regional impacts, the COVID-19 pandemic has exerted a global influence on human communities worldwide. The physical consequences of the pandemic include millions of cases and thousands of fatalities globally. Economically, it has resulted in business closures, disruptions in trade and travel, increased burdens on healthcare systems, and suspension of tourism activities. Socially, the pandemic has brought normal lives to a standstill, with individuals remaining at home, restricted social activities, and educational institutions closed. COVID-19 represents a biological disaster affecting the global population, with most countries demonstrating an insufficient capacity to effectively manage this crisis (Tercan et al., 2020). Similar to other disaster scenarios, artificial intelligence (AI) is being utilized in health-related issues such as post-COVID-19 syndrome (PCS). PCS is an escalating concern, with half of the patients continuing to exhibit symptoms a year after contracting COVID-19. Common symptoms include fatigue, difficulty in breathing, and mental and nervous problems, which can be severe. Early identification of individuals at high risk for PCS can facilitate appropriate care during recovery. One study examined symptoms, cardiac tests, and the six-minute walk test in 221 patients before and after hospital discharge. PCS was assessed three months after discharge. This study identified age, sex, inflammation, and oxygen demand prior to discharge as predictors of PCS. A neural network model was developed to predict PCS with high accuracy, thereby enhancing patient care post-COVID-19. Three months post-infection, 75% of hospitalized COVID-19 survivors exhibit PCS, with 89% accuracy in the model predicting PCS (Honchar et al., 2023). Another AI application during the COVID-19 pandemic pertained to social media. The usage rate of social media has been



increasing, particularly in specialized situations such as disasters affecting national agendas. During the pandemic, anti-vaccine publications and news proliferated as vaccine studies. Social media are undoubtedly a platform for disseminating such information. Studies have created datasets using AI programs to analyze content from social media platforms (such as Facebook and Twitter), classifying them as true, neutral, or false. This approach aims to safeguard public health by verifying the accuracy of online messages (Küçükali, Ataç, Palteki, Tokaç, & Hayran, 2022; Valeanu et al., 2024).

## **5. ARTIFICIAL INTELLIGENCE - FORENSIC MEDICINE**

In the event of a disaster, authorities must prioritize two critical tasks: the search and rescue of survivors and the identification and management of the deceased. In mass disasters, where thousands of bodies need to be individually identified, forensic teams face challenges, such as delays in identification due to long working hours and public health concerns due to the decomposition of bodies. An important data point in forensics is the age of individuals, which is crucial in determining refugee status and punishing criminals (Malmqvist, Furberg, & Sandman, 2017). Age estimation is also vital for identifying individuals at a crime scene. Traditionally, X-rays have been used for age estimation; however, their interpretation requires expert analysis. Currently, forensic dentists manually assess tooth age, a process prone to bias. This method is time-consuming and difficult to apply in large-scale disasters requiring a large number of identifications and a significant number of experts, thus increasing both workload and time. Emerging medical imaging technologies have the potential to develop computer programs that use data to facilitate faster and more reliable diagnosis

(Mohammad, Ahmad, Kurniawan, & Mohd Yusof, 2022). The emergence of artificial intelligence (AI) in medicine and dentistry has led to proposals for automating the current process as an alternative to traditional methods. They evaluated the accuracy and performance of a deep learning neural network system developed for age estimation on a large out-of-sample dataset of Malaysian children using digital dental panoramic imaging. Forensic Dental Estimation Lab (F-DentEst Lab) is a computer application developed to digitally estimate dental age. The introduction of this system has significantly improved the traditional method of age estimation (Mohammad, Ahmad, Gaus, Kurniawan, & Yusof, 2024).

## **6. CONCLUSION**

Artificial intelligence is increasingly being employed in disaster scenarios, demonstrating significant potential in emergency situations. In this context, rapid collection and analysis of large datasets is crucial for swift decision-making. The advantages of artificial intelligence in disaster management are summarized as follows: 1. Enhanced early warning systems: AI processes datasets to predict disasters and issues timely warnings. 2. Improved situational awareness: AI tools integrate satellite imagery, social media, and sensor data to provide real-time update. 3. Efficient resource allocation: AI optimizes resource distribution based on predictive models. 4. Automated damage assessment: AI analyzes post-disaster imagery to evaluate damage. 5. Personalized evacuation planning: AI develops evacuation routes tailored to individual needs. 6. Accelerated search and rescue: AI-powered drones navigate hazardous areas to locate survivors. 7. Advanced communication systems: AI facilitates overcoming language barriers during international responses. 8. Data-driven decision-making: AI analyzes historical

data to enhance preparedness. 9. Advanced risk assessment: AI identifies vulnerable areas and populations. 10. Streamlined recovery: AI expedites recovery through automated requests and aid distribution.

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# **Nursing Responses to Disasters: Managing Diabetes, Trauma, and Artificial Intelligence Technologies**

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