

DISASTERS AND HEALTH: A REVIEW FROM THE PERSPECTIVE OF THE BLUM MODEL

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Introduction

Disasters, both natural (earthquakes, floods, wildfires) and human-made (wars, terrorist attacks), significantly affect the capacity and effectiveness of healthcare services. During such events demand for health services increases rapidly. This surge in demand can overwhelm hospitals and healthcare facilities, causing shortages of medical supplies and personnel (Panwar & Sen, 2019; Uscher-Pines, 2009, p. 1). The sudden and unexpected healthcare needs caused by disasters strain the existing healthcare systems, often resulting in inadequate emergency medical interventions. Furthermore, infrastructure damage and transportation difficulties in disaster-affected areas can greatly restrict access to healthcare services.

Disasters such as earthquakes, floods, hurricanes, and fires can damage healthcare infrastructure, lead to shortages of healthcare personnel, and reduce the availability of medical supplies. These conditions decrease emergency response capacity and complicate the delivery of healthcare services in the long term (Banica et al., 2020; Yu et al., 2018). According to Blum's Model, which includes the four key social determinants of health (environment, behaviour, healthcare services, and genetic factors or heredity) individual health has both medical and social aspects (Tulchinsky, 2018). This perspective has evolved the definition of health over the years, from merely the "absence of disease" to encompassing "psychological, mental, and social well-being." Thus, disasters negatively impact each of these determinants, affecting the health of individuals and communities. For instance, earthquakes can alter the physical environment, deteriorating water and air quality, worsening housing conditions, and facilitating the spread of infectious diseases. Post-disaster lifestyle changes lead to increased stress and trauma. Health behaviors such as; nutrition, physical activity, and sleep patterns are adversely affected. Damage to healthcare infrastructure makes accessing healthcare services

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more difficult. Insufficient healthcare personnel and resources disrupt treatment and preventive health services. Genetic predisposition can exacerbate the health impacts of disasters (Bhugra & Ommeren, 2006). For example, individuals with genetic vulnerabilities may experience more severe psychological and physical issues triggered by stress.

Ensuring the rapid and effective delivery of healthcare services following disasters requires strong coordination between disaster management and healthcare services. Pre-disaster preparations are critical for maintaining the continuity of healthcare systems. These preparations include developing emergency plans, training of healthcare personnel, regular updates of medical supply stocks, and the establishment of mobile health units for use during disasters. In the post-disaster period, priorities include the prompt treatment of the injured, prevention of epidemic diseases, and provision of psychosocial support (Kourtit et al., 2023). During this process, collaboration between national and international health organizations as well as non-governmental organizations is vital. Furthermore, disasters prompt the reassessment of health policies and the development of strategies for disaster situations. The delivery of healthcare services is reshaped during the post-disaster recovery phase (Islam & Khan, 2018; Panwar & Sen, 2019). Policies should be structured to encompass preparedness, response, and recovery phases for disasters. Comprehensive planning and training programs are necessary to enhance community health and resilience. In conclusion, disasters affect the health status of individuals and communities in various ways. They leave deep impacts on the delivery of healthcare services, social structures, lifestyles, and environmental factors. Mitigating and managing these impacts requires holistic approaches and robust health policies.

1. Definition and Importance of Disasters

Due to its geological, topographic, and meteorological characteristics, Türkiye frequently experiences natural disasters. These features contribute to a high incidence of various disasters across the country, with earthquakes leading the list, followed by floods, avalanches, landslides, and rockfalls (Disaster and Emergency Management Presidency, 2018; Özdemir, 2005). The 2011 Tohoku earthquake in Japan, followed by a devastating tsunami, resulted in the loss of over 15,000 lives and caused extensive destruction to the country's infrastructure. One of the deadliest natural disasters in history, however, was the 1931 flood in China, triggered by heavy rainfall and river overflows. This catastrophic event impacted an area of over 50,000 square miles, resulting in an estimated 3.7 million deaths (Krichen et al., 2024). Areas experiencing these natural disasters, among others, suffer significant losses daily, depending on their economic status and population density. The frequency and severity of these events exacerbate vulnerabilities, resulting in increasing challenges for affected communities (Avdan & Alkis, 2011,

p. 17). When examining the types of natural disasters in Türkiye, it is evident that the majority of losses and damages stem from earthquakes, accounting for 66% of the total. Floods contribute 15% of the losses, while rockfalls represent 7%, and meteorological events account for 2%. This distribution underscores the significant impact of seismic activity on the country's overall disaster-related challenges (Genç, 2007). The pervasive occurrence of natural disasters in countries not only inflicts significant material and infrastructural damage but also amplifies social vulnerabilities, as affected communities face increased exposure to stressors and limitations in their ability to recover, thereby exacerbating challenges related to both environmental and social resilience.

The natural disasters experienced contribute to social vulnerability among individuals. This concept can be defined as the experience of harm or loss due to exposure to stress resulting from social and environmental changes, lack of care, insecure living conditions, and insufficient access to emergency services (Islam & Khan, 2018). Natural disasters are inherently destructive, often causing significant property damage and, in severe cases, loss of life. Their impact disrupts communities, infrastructures, and economies, highlighting the need for effective disaster preparedness and mitigation strategies to reduce harm (Panwar & Sen, 2019). In other words, natural disasters are defined as sudden environmental events that disrupt people's standard way of life, evoke feelings of helplessness, and cause suffering. After such events, access to essential needs—such as shelter, food, and healthcare—often becomes severely limited, highlighting the immediate necessity for organized relief and recovery efforts (Gürbüz & Karadeniz, 2021). People frequently face threats from both natural and human-made disasters, which can cause extensive damage, human suffering, and serious economic repercussions. Such events underscore the importance of effective preparedness, resilience-building, and responsive recovery measures to mitigate harm (Yu et al., 2018, p. 1). Throughout history, natural disasters have caused widespread destruction, often resulting in significant loss of life. Events such as earthquakes, volcanic eruptions, hurricanes, floods, and wildfires profoundly impact human communities and the environment, leading to long-term social, economic, and ecological consequences (Krichen et al., 2024). The Centre for Research on the Epidemiology of Disasters (CRED) has established four criteria for an event to be classified as a natural disaster. If at least one of these criteria is met, a natural event can be considered a disaster. The criteria are as follows (The International Disaster Database (EM-DAT, 2014):

- At least 10 deaths,
- At least 100 people affected,
- Declaration of a state of emergency,

- Request for international assistance.

Disasters can be both natural and man-made (Seaberg et al., 2017, p. 87). Man-made disasters can be attributed to human actions, whether they are induced or constructed by human effort. These types of disasters arise from human activities, and it is possible to take preventive measures, establish safety protocols, and thereby prevent them from occurring (Velimirovic, 1980). Furthermore, according to Velimirovic (1980) the boundary between natural and man-made disasters is sometimes blurred. Many adverse effects of natural disasters can be traced back to human actions, such as poorly constructed buildings. A forest fire caused by lightning is a natural disaster, while one ignited by a carelessly discarded cigarette is considered a human-caused disaster. This distinction highlights the importance of understanding human influence on disaster risk and emphasizes the need for comprehensive disaster management strategies that consider both natural and anthropogenic factors. In this context, the impacts of disasters are not limited to direct environmental destruction; they can also deeply affect social, economic, and cultural structures. Humanity must take greater responsibility for developing preventive strategies and minimizing the effects of disasters. Disaster prevention and management are crucial not only for protecting human lives but also for enabling societies to achieve sustainable development goals. Therefore, a comprehensive approach that considers both natural and anthropogenic factors will contribute to the construction of more resilient and secure communities.

2. Definition of the Blum Model and Disaster Health Impacts

Each individual may have a personal definition of what constitutes health and well-being, but a common standard for assessing an individual's health is known as Blum's Model of Health Determinants. This model refers to four aspects that collectively influence an individual's well-being: heredity, medical services, environment, and lifestyle. While each component impacts health, some factors exert a greater influence than others (Batarseh, 2018). Blum's model allows for the evaluation of human health in the context of an ecosystem and suggests that the four major determinants of health are shaped by five key background factors: population, culture, mental health, natural resources, and ecological balance. These five factors determine how much each of the four determinants influences health and how they affect individuals' well-being. Each of the four determinants is an important element contributing to health levels through the combination of these five factors (VanLeeuwen et al., 1999). The four main themes in this diagram—environment, inheritance (genetics), healthcare, and behavior—are fundamental elements that affect health in a multifaceted way. Each of these themes represents important factors that influence an individual's health from different perspectives. These four main themes are continuously interacting with one another and collectively shape health in a multidimensional way (Tulchinsky,

2018). When considered as a whole, they determine the overall well-being and quality of life of individuals.

The environment refers to the physical, social, and cultural structures in which an individual lives. This theme encompasses a wide range of factors that affect an individual's health. These factors include the developmental process during the fetal stage, the natural and human-made physical environment, socio-cultural influences, education, employment opportunities, and economic conditions. Environmental factors such as air quality, access to water resources, and the presence of a safe living space can directly impact an individual's health. Similarly, socio-cultural structure and education level shape an individual's health-related awareness and attitudes. Environmental conditions are a key factor in determining an individual's quality of life.

Genetics or inheritance refer to the genetic characteristics inherited from an individual's family and represents the biological factors that influence health. Genetic structures play a crucial role in determining many health-related traits, such as susceptibility to diseases, immune system characteristics, and metabolic functions. For instance, an individual with a family history of genetic diseases may be at a higher risk of developing these conditions. Genetic factors are considered immutable characteristics that affect health, but these risks can be reduced or managed through healthcare services and lifestyle changes.

Healthcare refers to the services provided to individuals to maintain health, prevent diseases, treat illnesses, and support the recovery process. The effectiveness of healthcare systems is one of the key elements enabling individuals to lead healthy lives. Healthcare includes preventive services (e.g;vaccination, screenings), therapeutic services (treatment of diseases), and rehabilitation services (recovery and restoration processes). Access to healthcare services and the quality of these services directly affect the overall health level of society. An effective healthcare system not only helps individuals cope with diseases but also supports the implementation of preventive and protective measures.

Behaviour refers to the conscious or unconscious choices and actions individuals make regarding their health. An individual's health habits and lifestyle behaviors are among the most important factors determining their health status. Factors such as dietary habits, physical activity levels, smoking, and alcohol consumption directly affect health. Additionally, psychological and social behaviors, such as coping mechanisms for stress and sleep patterns, can influence both the mental and physical aspects of health. Adopting a healthy lifestyle can reduce the risk of diseases and improve overall quality of life.

Chronic conditions can be significantly worsened by the adverse circumstances resulting from a disaster, such as food shortages, inadequate access to clean water,

extreme temperatures, physical and mental strain, injuries, and exposure to infectious agents. Furthermore, natural disasters pose a heightened risk to vulnerable populations, including individuals with limited mobility, pregnant women, and their unborn children, increasing the likelihood of negative health consequences for these groups (Mensah et al., 2005). Vulnerable populations, including persons with disabilities (PWD), in developing countries are among the most adversely affected by disasters. They experience severe health impacts and have limited opportunities to implement coping and resilience strategies, further exacerbating their vulnerability in the face of such crises (Uddin et al., 2024). Regardless of whether exposure to disasters is direct or indirect, a disaster can have a profound impact on individuals' social and psychological functioning. The emotional and mental strain caused by such events can disrupt social relationships, alter coping mechanisms, and lead to long-term psychological challenges for affected individuals (Bhugra & Ommeren, 2006). Disasters occur when a community faces a severe disruption that exceeds its capacity to cope using its own resources, resulting in human, material, economic, or environmental losses. These events overwhelm the community's ability to function effectively, leading to significant consequences across various sectors (Mitchell et al., 2024). During a disaster, immediate threats to public health become highly evident as emergency response unfolds. In such critical moments, the health system is quickly overwhelmed by a surge in demand for urgent medical care, driven by initial waves of injuries and acute health needs (Davis et al., 2021, p. 2).

Natural disasters often have devastating and lasting impacts on societies, economies, and humanity as a whole. Their occurrence disrupts social structures, strains economic stability, and challenges the resilience of affected populations, leading to widespread and enduring consequences (Seaberg et al., 2017, p. 1462). According to the United Nations Office for Disaster Risk Reduction (2015), disaster impact is the total effect of a hazardous event, including both its negative impacts (e.g., economic losses) and positive effects (e.g., economic gains). This term encompasses economic, human, and environmental impacts and may include death, injury, illness, and other adverse effects on individuals' physical, mental, and social well-being. The initial impacts of a natural disaster often include fatalities, health issues, and disruptions to essential infrastructure services such as electricity, transportation, water, and communication. Food and supply shortages, interruptions in education and healthcare services, and housing and shelter issues are also part of these primary impacts. These initial effects are followed by subsequent economic consequences, such as income and employment losses, shifts in the sectoral composition of production, inflation, and other related challenges (Keyifli, 2020). An effective disaster response mechanism not only addresses immediate needs but also fosters resilience for future events. It can establish a foundation for restoring and strengthening economic and ecological

systems disrupted by a natural disaster, promoting long-term sustainability and aiding in recovery while preparing for potential future shocks (Kourtiti et al., 2023).

The lack of knowledge, attitudes, and behaviors in communities regarding natural disasters contributes to the increasingly complex and severe impacts of such events over time. This situation underscores the growing importance of preparedness, risk reduction, and awareness initiatives to mitigate the adverse effects of natural disasters (Demirdelen & Çakıcı, 2021). A disaster does not discriminate in whom it affects; however, limited research indicates that impoverished and medically underserved individuals, particularly those living in rural areas, bear this burden disproportionately. This highlights the need for targeted interventions and support to reduce vulnerability in these populations (Andrulis et al., 2007). This condition is termed vulnerability, fragility, or susceptibility. In this context, a thorough understanding of societal vulnerabilities is essential, requiring a multi-sectoral approach aimed at reducing social inequalities and economic risks, as well as policies that target the underlying causes of individual and societal fragility (Çakmak et al., 2018, p. 94).

In conclusion, the impact of disasters on health is not limited to immediate physical injuries. Disasters lead to multifaceted health outcomes influenced by environmental factors, genetic predispositions, access to healthcare, and individual behaviors. Following a disaster, environmental factors, especially elements such as water contamination, air quality, and housing conditions, directly affect health. This highlights the importance of environmental factors in the aftermath of a disaster, which is directly linked to the environmental components of Blum's Model. Furthermore, disasters can exacerbate health issues in individuals with genetic vulnerabilities. For instance, stress may exacerbate health problems in genetically predisposed individuals, affecting both their psychological and physical health. Additionally, behavioral changes post-disaster (such as alterations in eating habits, smoking, or alcohol consumption) can negatively influence individuals' health. This aligns with the behavioral factors in Blum's Model. During disasters, the demand on healthcare systems increases, and the overwhelming strain on healthcare infrastructure directly affects the effectiveness and accessibility of healthcare services. In Blum's Model, the role of healthcare services becomes critical in disaster scenarios, and the impact of these services on public health grows in such contexts. Furthermore, the effects of disasters are particularly pronounced on vulnerable populations, such as individuals with disabilities, the elderly, and pregnant women. These groups may face limited access to healthcare services, and their recovery process is typically longer post-disaster. In Blum's Model, factors such as environment, genetics, and healthcare access play a significant role in shaping the health levels of these populations. Finally, the social, economic, and

psychological impacts of disasters interact with the four main components of Blum's Model (environment, genetics, healthcare, and behavior) providing an essential approach for understanding the multifaceted health effects of disasters and assessing how recovery processes unfold.

3. The Blum Model in Disaster Management

3.1. Strengthening health systems

Healthcare providers are crucial to disaster response efforts due to their frontline roles and extensive skill sets. Their expertise enables effective medical intervention, rapid response, and the management of health-related challenges in the aftermath of catastrophic events (Aslanoglu et al., 2024). Hospitals, clinics, and public health systems are vital after natural disasters or intentional attacks in any country. Physical damage or supply chain disruptions in these facilities can hinder effective interventions and worsen crisis outcomes. Even if not directly affected by the disaster, these facilities must operate efficiently to care for large numbers of patients simultaneously (Arboleda et al., 2007, p. 302). Therefore, strengthening healthcare infrastructure and preparing it for disasters is crucial not only to maintain the functioning of health systems but also to accelerate societal recovery after a disaster.

Many studies advocate for the development of a comprehensive, community-wide disaster preparedness plan that integrates all components of the healthcare sector. Creating such a plan relies on having a clear management structure capable of coordinating actions across multiple institutions. This coordinated approach ensures an effective and efficient disaster response, minimizing negative impacts on public health (Lamberti-Castronuovo et al., 2022). In a study conducted by Arboleda et al. (2007), the use of system dynamics to assess the vulnerability of a healthcare facility during a disaster was examined, and a model was proposed. The model analyzed the impact of infrastructure disruptions on patient flow, considering factors such as capacity adjustment and referral possibilities. Stock and flow-based measures were recommended, emphasizing that the hospital could serve more patients during the initial hours of intervention. These strategies aim to enhance the efficiency of healthcare services during a disaster and highlight the importance of infrastructure and management measures for a healthcare system to respond quickly and effectively. Implementing such models and measures enables healthcare facilities to utilize their capacities more efficiently during disasters, while also providing the opportunity to intervene with more patients in a timely manner. Therefore, a disaster-prepared healthcare system strengthens community resilience to crises and accelerates the societal recovery process. Strengthening health systems in the context of disaster preparedness is not only essential for maintaining the functionality of healthcare services during crises but also for

facilitating rapid recovery and ensuring long-term resilience. According to Blum's model, the integration of health systems within broader environmental and societal frameworks is vital for enhancing the adaptive capacity of communities. Strengthening health infrastructure, improving coordination across sectors, and ensuring that systems are responsive to both immediate and long-term needs, aligns with Blum's emphasis on holistic, context-specific approaches that account for both human and environmental factors in disaster risk management. This integrated approach supports the development of more resilient health systems capable of addressing both the direct and indirect impacts of disasters.

3.2. Community resilience and community-based intervention strategies

Risk is a function of two factors: natural hazards and vulnerability. Both elements provide the necessary conditions for risk formation. For instance, of the 100,000 recorded earthquakes each year, only those occurring in densely populated areas lacking resilient infrastructure systems escalate into disasters (Charvériat, 2000, p. 41). Disasters occur as a consequence of the interplay between natural hazards and human vulnerabilities, where the severity of the impact is determined by the extent of both environmental threats and the societal factors that contribute to human susceptibility (İnmez, 2011, p. 186). Banica et al. (2020) emphasize that the impact of natural disasters is directly correlated with the responses they provoke, and that the combination of vulnerability and exposure amplifies their effects. Banica et al. (2020) also highlight the significance of resilience in mitigating these impacts. At this point, the importance of resilience is also highlighted. Individuals with low socioeconomic status, those without health insurance, and people with mental health conditions or disabilities are other vulnerable populations who are more likely to experience higher morbidity and mortality during disasters (Mensah et al., 2005). It is not the natural movements of Earth's elements that cause disasters, but rather the vulnerability arising from the capacity of people in the region to adapt to their environment and the inequalities created by humans. It is crucial to consider socioeconomic inequalities and vulnerabilities during both pre-disaster risk reduction efforts and post-disaster response, rehabilitation, and reconstruction phases (Çakmak et al., 2018, p. 94).

Birkmann et al. (2010), suggest that the effects of natural disasters are directly linked to the scale of the disaster. Small-scale disasters can typically be managed and mitigated by institutions or communities without significant disruption. However, large-scale disasters often lead to irreversible changes, overwhelming institutions and communities, causing long-term socio-economic impacts and requiring substantial efforts for recovery and rebuilding. The severity, types, and impacts of natural disasters vary depending on the country, region, and specific characteristics of the event. These factors influence the extent of damage and the challenges faced by affected areas in responding to and recovering from disasters

effectively (Şahin, 2017).

In this context, community resilience and community-based intervention strategies play a crucial role in enhancing the ability of affected populations to respond to and recover from disasters, as they foster local ownership, capacity-building, and the mobilization of resources tailored to the unique needs of the community. According to Blum's model, the environmental dimension emphasizes the importance of sustainable and adaptive practices in disaster management. By integrating environmental considerations into community-based strategies, communities can better mitigate the impacts of disasters, reduce vulnerability, and promote long-term resilience in both ecological and social systems.

3.3. Long-Term health effects

Exposure to disasters, as defined by the United Nations Office for Disaster Risk Reduction (2009), refers to “the situation of people, infrastructure, housing, production capacities, and other tangible human assets located in hazard-prone areas.” When individuals and assets are exposed to such hazards, the potential for severe or lasting injuries increases, which may lead to income loss and rising healthcare expenses. Furthermore, disease outbreaks and violence often follow disaster events, with these impacts largely shaped by the quality of disaster management. Natural disasters like earthquakes, storm surges, and floods commonly damage water distribution systems or contaminate water supplies, thereby heightening the risk of waterborne diseases in the aftermath (Charvériat, 2000, p. 11). Such environmental hazards not only pose immediate health risks but can also lead to long-term, chronic conditions for those directly impacted by disaster sites.

In addition to immediate health risks, environmental hazards in disaster settings can also lead to chronic health conditions among those directly exposed. For instance, a study conducted on firefighters who responded to the World Trade Center collapse in New York found that the respiratory issues they experienced were equivalent to 12 years of aging. It was reported that the clouds of dust and smoke generated during and after the collapse of the World Trade Center (WTC) on September 11, 2001, contributed to these health issues (Banauch et al., 2006). At this point, this highlights the significant long-term health impacts of disasters. These effects are not only physical but also manifest mentally, which is another critical aspect. This is especially relevant since the definition of health encompasses physical, social, and mental well-being. In this context, studies have shown that natural disasters can lead to long-term stress-related disorders (Chen et al., 2014; Li et al., 2024; Uscher-Pines, 2009). The model developed by Uscher-Pines (2009) comprehensively addresses the factors underlying changes in health status among displaced disaster victims. It explains the challenges faced by

victims and the impact of these experiences on health outcomes. In the model, two distinct groups are highlighted: “unrelocated” and “relocated” victims. The factors affecting the health of relocated victims are examined under four main headings:

1. **Healthcare Disruption:** Issues such as loss of medical records, lack of access, termination of doctor-patient relationships, care avoidance, and interruptions in treatment regimens are the primary obstacles to accessing healthcare. These disruptions have a direct impact on the deterioration of health status.
2. **Social Network Changes:** The positive or negative effects of relocation on social relationships play a significant role in the psychosocial well-being of individuals. Strengthening or weakening of social support networks can influence victims’ ability to cope with health challenges.
3. **Changes in Living Conditions:** The adaptation process to a new living environment can have both positive and negative impacts on individuals’ health. These changes directly affect the way victims sustain their daily lives, which, in turn, is reflected in their health status.
4. **Psychological Stressors:** Psychological stress factors, such as loss of control, feelings of unfamiliarity, identity concerns, and limited opportunities for self-help, create pressure on mental health.

In conclusion, the model provides a comprehensive framework for understanding the complexity of health status in post-disaster contexts. Disasters can have significant long-term health effects, including chronic physical and psychological consequences. Displaced individuals often face ongoing healthcare disruptions, such as limited access to medical records and services, which can lead to untreated conditions and worsening health. Changes in social networks and living conditions, along with psychological stressors such as; loss of control and unfamiliar environments, may also contribute to increased vulnerability. These factors can result in heightened mortality, chronic illnesses, mental health disorders, and reduced quality of life over time.

3.4. Policies and practices

Within the framework of the Blum Model, the provision of healthcare services during disasters is critical for addressing the biological, environmental, and behavioral health needs of individuals. It is particularly vital in meeting the needs of vulnerable groups, such as those with chronic illnesses or disabilities, post-disaster. This approach should not only involve treatment but also continuous care plans to maintain the overall health of disaster victims. Therefore, a comprehensive strategy addressing the general health of disaster victims should include not only

evacuation and emergency treatment plans but also strategies to provide care for vulnerable populations, including pregnant women and individuals with chronic illnesses or disabilities. Preparations for preventing and controlling chronic diseases, secondary conditions in people with disabilities, and adverse pregnancy outcomes during disasters should be driven by these considerations (Mensah et al., 2005):

1. The pre-disaster rates of adverse health outcomes and disease burden,
2. Awareness of the emergency needs of individuals with chronic diseases (including plans for providing essential medications),
3. Knowledge of the basic and immediate capacity of affected and surrounding healthcare systems to treat and manage chronic diseases, and
4. The ability to rebuild the essential infrastructure needed to support care in these areas.

Today, the most important document adopted by countries for disaster risk management worldwide for the years 2015-2030 is the Sendai Framework, which is an improvement on the Yokohama and Hyogo Frameworks. The primary objective of this framework is to enhance international cooperation in enhancing national and global disaster preparedness efforts through national action plans (Şahin, 2017). This framework contributes to strengthening countries' national action plans by presenting four key priorities for disaster risk reduction: Understanding risk, enhancing governance capacity for risk management, implementing risk reduction measures, and strengthening post-disaster recovery processes. It aims to ensure coordination among all stakeholders through international cooperation, information sharing, and technical support. The Sendai Framework for Disaster Risk Reduction 2015-2030 establishes global goals for reducing disaster risk while promoting adaptability to local contexts. Given that disaster risk varies across time and space based on factors such as hazard, vulnerability, and exposure, a one-size-fits-all approach is insufficient. The framework measures success through outcome-oriented indicators, including reductions in mortality, affected populations, and economic losses. It also emphasizes strengthening national strategies, fostering international cooperation, and enhancing early warning systems. Additionally, the framework supports the development of localized strategies and indicators tailored to each country's unique needs, fostering a balance between global objectives and national implementation (Global Protection Cluster, 2023; Kimber & Steele, 2021; Tozier De La Poterie & Baudoin, 2015; United Nations Office for Disaster Risk Reduction (UNDRR, 2023).

In a study conducted by Aslanoğlu et al.(2024), it was determined that the knowledge and skill acquisitions of health sciences students regarding disaster preparedness education are of critical importance for educators and policymakers.

The study emphasized the significance of integrating disaster preparedness education into health sciences curricula and suggested the allocation of funds and resources to expand this training. Additionally, it was proposed that access to training be increased through the use of technology and remote learning platforms, and that various interactive teaching methods be employed to enhance student participation and knowledge retention. The study highlighted that practical training, such as CPR, is valuable in preparing students for real-life scenarios, and that the program should offer an adaptable learning environment with continuous feedback, thereby enhancing student satisfaction (Aslanoğlu et al., 2024). In this context, disaster preparedness education aims to equip students with the knowledge and skills necessary to adapt to environmental conditions, encourage behavioral changes, and enhance the resilience of healthcare systems in the face of disasters. The study emphasizes the importance of incorporating the highlighted policies and training programs into the curriculum, as this will facilitate effective post-disaster interventions and strengthen the resilience of healthcare services during crises. Thus, the integration of disaster preparedness education into health sciences curricula not only develops students' knowledge and skills but also contributes to shaping the necessary policies and practices needed to enhance the resilience of healthcare in response to disasters. Policymakers and educators must develop training strategies for effective disaster response and integrate these strategies into national health plans. Within the framework of the Blum Model, a holistic approach is required to address environmental, biological, and behavioral health needs. Such policies can help ensure the implementation of preventive measures to reduce disaster risks, enable healthcare systems to function more effectively during disasters, and accelerate post-crisis recovery processes. Furthermore, providing the necessary resources and funding to expand disaster preparedness education will facilitate the nationwide dissemination of such training. International collaboration, information sharing, and coordination are crucial for enhancing disaster response capacity, thus necessitating the strengthening of relevant policies and practices at a global level.

Conclusion

In conclusion, disasters, whether natural or human-made, present complex challenges that significantly affect healthcare services and the well-being of affected communities. The multifaceted impacts of disasters—ranging from infrastructure destruction to a sudden surge in health service demand—strain existing healthcare systems and create considerable gaps in both emergency and routine care. According to Blum's Model, the key health determinants (heredity, behavior, environment, and healthcare services) are all deeply disrupted during disasters, with lasting consequences for individuals and communities. To mitigate these effects, it is essential to implement targeted and actionable strategies.

First, robust disaster preparedness plans must be established, focusing on the development of specialized healthcare infrastructure capable of responding to surges in demand. This includes the creation of temporary medical facilities and ensuring sufficient availability of medical supplies for immediate deployment. Second, establishing rapid-response mechanisms, such as emergency medical teams and telemedicine services, can ensure the swift mobilization of resources during crises. Moreover, strengthening collaboration between local, national, and international organizations is crucial for improving the overall disaster response. Joint training exercises and communication protocols should be regularly conducted to ensure efficient coordination when disasters strike. Additionally, disaster management policies should incorporate a dual focus on resilience-building and post-disaster recovery. This includes not only addressing urgent healthcare needs but also implementing long-term mental health and rehabilitation programs to promote community recovery. Finally, policies should focus on creating sustainable health systems that prioritize preparedness, adaptability, and recovery. By integrating Blum's health determinants framework into disaster management, future healthcare interventions can be more comprehensive, addressing both immediate and long-term health outcomes while fostering greater community resilience in the face of future crises.

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