

Emergency Medicine and Disaster Management

Concepts and Models

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Both emergency medicine and disaster management play a critical role in all types of disasters. Good planning, effective implementation, and timely adjustments can reduce the catastrophic impacts of disasters, and enhance processes such as emergency preparedness, relief, and rehabilitation. In this chapter, important aspects of emergency medicine and disaster management are discussed. The role of emergency medicine is illustrated with different models of pre-hospital emergency medicine and triage systems, and examples of disaster management systems are described. Over the past decades, the disaster management cycle has been a widely recognised framework and comprehensive approach adopted in disaster management. This chapter discusses the important components of a disaster management cycle. Perspectives on the adoption of the management framework are summarised based on some illustrative examples and experience derived from international collaboration in humanitarian responses to disastrous events. Furthermore, research and education in emergency medicine and disaster management are presented. The cases described in this chapter provide insights into emergency medicine and disaster management, which are paramount for the effective preparation for and management of future disastrous events.

Disasters, Emergency Medicine, and Disaster Management

Every year, over 190 million people are affected by disasters around the world, which has huge impacts on the health of people in general. There are serious national, regional, and global events, such as earthquakes, cyclones, disease outbreaks, bushfires, floods, and droughts. There are also localised incidents, such as fires, traffic accidents, and the collapse of structures such as buildings and bridges. A large number of these events are devastating, involving a massive cost of human life and property (World Health Organisation, 2019).

A disaster is a major event in which the normal livelihoods of people and the operations of society are seriously affected. Disasters cause huge human and material loss, which exceeds the capacity of the affected society to cope using its own resources. The basic structures and essential functions of the society, particularly the government and the community, are slowed down or halted. Disasters are usually the consequences of unexpected—but occasionally anticipated or predicted—events or large-scale incidents that result in the destruction of property and damage to social, economic, and political infrastructures, with potentially fatal or long-term health and economic effects. There are two types of disasters: natural and human-caused. Natural disasters arise from extreme climate-related causes or are due to the geographical ecology of the Earth. Examples include floods, droughts, hurricanes, storms, snow-related disasters such as avalanches, tornadoes, earthquakes, volcanic eruptions, and tsunamis. Human-caused disasters can be either intentional or unintentional. Examples of unintentional human-caused disasters include traffic accidents, fires, gas poisoning, chemical spills, collapsed buildings, and nuclear disasters. Examples of intentional human-caused disasters are often forms of attacks or terrorism, including cyber attacks, shootings, biological and chemical sabotage, riots, and damage to public property (Klein and Irizarry, 2021). They can also be overt or covert, which make prevention and response challenging.

The Roles of Emergency Medicine in Major Events

Emergency medicine is a medical specialty concerned with the care of illnesses or injuries requiring immediate medical attention. Emergency medicine

consists of four main components: assessment, management, treatment, and prevention. It requires constant readiness, as it focuses on the assessment and care of patients in unpredictable medical and social emergencies, whenever and wherever they occur. Emergency medicine has to come to the rescue of the injured in a limited timeframe, making it stressful for caregivers (Bouillon-Minois et al., 2021). Some victims may die because of late responses or treatment. Thus, detailed planning and immediate response procedures are essential in emergency medicine, as well as in disaster management. There are guidelines for directing medical and health professionals in terms of taking care of the affected individuals in an emergency.

Emergency medicine plays an important professional role in all disasters. It entails spotting the issue faster and speedier clinical diagnoses than in normal medical practice, and is the most appropriate and urgent form of interim management during disasters, as it increases the chances of survival. There is a practice called the triage system, which categorises disaster victims into different levels of injuries, and they are treated according to the seriousness of their injuries and the urgency of medical care needed. This system plays a critical role in allowing patients most in need to be treated first in the aftermath of a major disaster, though it has been noted that there may be needy patients not designated as high acuity at triage (Hinson et al., 2019). Without the support and development of emergency medicine in disaster management, the number of deaths from injuries and illnesses will increase. Hence, emergency medicine and disaster management are closely linked.

Models of Pre-hospital Emergency Medicine and Triage Systems

Pre-hospital emergency medicine specialists treat patients who need rapid and supporting treatment through quick assessment, prompt diagnosis, appropriate treatment, and the coordination of procedures and care. In contrast to general medicine, the provision of emergency medicine is not confined to a single or fixed location and can occur in a variety of settings—not only in medical institutions but also inside ambulances, at the scene of disaster, and in site hospitals (American College of Emergency Physicians, 2021).

To make emergency medicine a more representative and concrete discipline, the United States government has established the Model of the

Clinical Practice of Emergency Medicine (EM Model). Its creation involved six collaborating organisations: the American Board of Emergency Medicine, the American College of Emergency Physicians, the Council of Emergency Medicine Residency Directors, the Emergency Medicine Residents' Association, the Residency Review Committee for Emergency Medicine, and the Society for Academic Emergency Medicine (Council of Residency Directors in Emergency Medicine, 2019). The EM Model has three main components. The first component is an assessment of the acuity of the victim. This assessment is carried out by medical staff, and not by the affected person, because the latter can seldom identify the underlying issue; they can only present their symptoms. The second component is a description of the provision of appropriate emergency medical care. A full description of the medical care allows the disaster victim to understand the process of care and to follow the instructions from practitioners more easily. Finally, the third component consists of medical knowledge, patient care, and procedural skills. Through this, the victim is made aware of their own physical condition (Council of Residency Directors in Emergency Medicine, 2019).

Emergency medicine is inseparable from disaster management, in that it is used to help and treat injured patients in the immediate hours following a disaster. In the aftermath of a disaster, there is usually a large number of casualties, each with very different kinds of injuries, such as radiation poisoning, blood loss, hypothermia, and infectious diseases. Emergency medicine encompasses a wide range of expertise in order to deal with such a wide range of patients and injuries (Drzezo, 2019). In addition, there is a special classification system—the triage system—in emergency medicine, which helps medical and nursing staff to provide care according to the type and urgency of treatment. The emergency medicine teams are led by emergency physicians, who help to allocate resources and direct the management of casualties in order to save lives (Drzezo, 2019).

Emergency medicine is not just about helping patients to heal. It can also mitigate the effects of a disaster before it happens (Catlett et al., 2011; Liu et al., 2021). It comprises preparedness, disaster relief, and community recovery. Emergency medicine involves a well-defined system of emergency response, which prepares resources and equipment for the aftermath of

a disaster and sets up emergency centres and field hospitals. In terms of communication, emergency medicine integrates the communication systems of various departments to enhance the flow of information. It is crucial that team members undertaking emergency medicine regularly undergo training and drills. Their knowledge and skills must be continually evaluated and improved with reference to clinical and scientific findings (Catlett et al., 2011; Liu et al., 2021). Protocols for the even transfer of disaster victims to a group of hospitals are also developed in order to avoid overloading one hospital.

In the event of a disaster, practitioners of emergency medicine work across four areas: (i) participating as leaders of a unified command, (ii) carrying out triage, (iii) acting as an authority in the establishment of protocols, and (iv) taking up a community and national role in the provision of emergency medical services.

Participation in a unified command enables the development of appropriate strategies and the establishment of a clear leadership role. Emergency medical care providers have a high level of authority to make important decisions (Catlett et al., 2011; Liu et al., 2021). Then, there are appropriate triage systems to prioritise the care of victims in terms of seriousness and acuity, and to decide on either the provision of immediate treatment or transfer.

Each country uses a different triage system. The most common classification systems are the Australasian Triage Scale (ATS), the South African Triage Scale (SATS), the Canadian Triage and Acute Scale (CTAS), the Manchester Triage Scale (MTS), and the Emergency Severity Index (ESI). They all involve five levels of severity that can be used to prioritise patients. Each classification system is different. The ESI is concerned with the patient's vital signs and relies on the intuition of healthcare workers. In contrast, the CTAS and MTS have strict rules, and both systems rely on data to determine the category to which a patient belongs. The ATS, CTAS, MTS, and ESI require more resources, while the SATS works in a limited resource environment and is more effective in developing countries and in places where resources are scarce (Hinson et al., 2019).

Emergency medical services (EMS) play important roles in disaster response. It has been acknowledged that standard protocols, such as the National EMS Scope of Practice Model in the US, may need to be modified in emergency events (Catlett et al., 2011). EMS providers should be flexible in

their use of medication and procedures in cases that require decisions beyond the typical protocols. Such conditions may arise from the lack of availability of ordinary interventions due to disrupted transport and limited access to healthcare facilities. During pandemics, expanded scopes of practice are critical for exploring the administration of vaccines and new medications.

In the aftermath of a disaster, emergency medical care also plays an important role in community recovery. Most hospitals and emergency centres are often severely understaffed after a disaster, and they need to replenish a large number of staff and refill patient care supplies and equipment. Emergency healthcare workers are normally expected to work until the affected hospital is back to its normal operating level. In addition, different caregivers and staff are prone to experiencing significant psychological stress, and emergency medical staff will help to alleviate the stress and develop plans to improve the psychological impact of the disaster (Catlett et al., 2011; Liu et al., 2021).

Goals of Disaster Management

Disaster management is the process of anticipating the type of disaster, preparing for action, estimating the chances of a disaster occurring, and initiating appropriate responses. The goals of disaster management are to prevent a disaster from occurring and to minimise the impact if it does occur. This includes the recognition of disastrous events as early as possible, so that rescue teams and the public are alerted; immediate and holistic management of disasters in order to minimise the damage to human life, infrastructure, and property; and the mitigation of the impacts on the community with the preventive measures already developed. There are five areas that need to be taken into account when preparing and developing disaster prevention measures: staff psychology, tools and equipment, sources of supplies, the training of staff and drills for the disaster, and a thorough understanding of disaster prevention and management plans. It is important to note that reducing the loss of human lives and resources is an important part of disaster management, as there is always a shortage of human resources arising from injury, loss of life, or difficulty accessing the scene during a disaster. After a disaster, the community needs to return to normalcy quickly and smoothly, so disaster management must also include relief work to

help the community to recover. All the processes of disaster management are therefore grouped together to form a disaster management cycle.

Disaster Management Cycle

There are a number of models, procedures, and frameworks that can be used to help the government, agencies, and rescuers handle a disastrous event. The disaster management cycle is the most preferred framework and has been recognised as a successful and well-known approach to disaster management. It involves preparation, assistance, and rebuilding the community when a human-caused or natural disaster occurs (Al-Jazairi, 2017). The cycle also helps to assure the safety and security of the community and the workplace. Conventionally, the disaster management cycle is composed of four stages—preparedness, response, recovery (rehabilitation, reconstruction), and mitigation (prevention) (Bhattacharya, 2012; Sawalha, 2020). Unfortunately, many governments and institutions only focus on the steps to be taken when a disaster strikes. There have been suggestions to include strategic thinking, future-open thinking, and systems thinking in the cycle so that it will operate more effectively and reduce avoidable impacts (Sawalha, 2020). In 2019, the World Health Organisation (WHO) released the Health Emergency and Disaster Risk Management Framework (WHO, 2019).

1. Preparedness

The first stage of the disaster management cycle is preparedness, which is an ongoing process in disaster management. Individuals, communities, businesses, governments, and non-governmental organisations (NGOs) plan, train, and prepare for what everyone should do during emergencies and disasters. Preparedness is defined as a continuous cycle of planning, organising, training, and exercising actions, which ensure the highest level of readiness and improve the capacities of the government, the community, and civil society to manage natural and human-caused catastrophes (Bhattacharya, 2012). Fire drills, major event exercises, aircraft crash simulations, sea rescue exercises, and evacuation rehearsals are regularly organised by the government as preparation for prompt and effective responses to disasters. Examples of

preparedness measures are (i) the development and maintenance of updated and valid disaster strategies that can be activated at any moment; (ii) preparation for emergencies by evacuating and temporarily moving people to safe havens; (iii) the installation of early warning systems; (iv) the building of a robust communication network with wide geographic coverage; (v) the implementation of smart logistical and transportation plans; and (vi) the enhancement of public awareness and continual public education, plus drills and exercises related to emergency plans. Such measures should be reviewed and improved with time, new technology, and evaluation. Preparedness is discussed further in both a later part of this chapter and several other chapters.

2. Response

The response stage consists of an intervention that fulfils the immediate needs of the impacted population during or immediately after a disaster (Ha et al., 2019). The government should have designated officials as disaster management leaders who will be in command and will coordinate the response process in the appropriate and timely use of materials and human and financial resources, including rescuers, supplies, and equipment, to help restore and maintain the safety of the people and environment affected, as well as to minimise or avoid the risk of further damage to life and property. This stage should be as brisk and brief as possible but, depending on the nature of the disaster, it may last for a long time. Appropriate disaster response depends on well-informed choices made by senior officials as the result of an assessment of the impacts and support at hand, in combination with the management of both public and private institutions. The response stage is also guided by the needs of the affected communities, based on reliable information and data from the scene, not on assumptions made from afar or through “word of mouth”. For instance, Blumont, the United Nations (UN), and the media have made use of appropriate data to evaluate the number of people likely to be exposed to major disasters, such as Cyclone Nargis in Myanmar and earthquakes in the Sichuan province of China. The US National Aeronautics and Space Administration’s (NASA’s) Socioeconomic Data and Application Centre also provides data that estimate the number of people who are exposed to specific disasters around the world.

The response stage also involves meeting the interests and urgent needs of victims during or immediately after the occurrence of a disaster (Sandler and Schwab, 2021). It involves the location, organisation, and mobilisation of emergency equipment and human resources, particularly time-sensitive actions, such as search and rescue operations; evacuations; the provision of emergency medicine, food, water, and shelters; and the planned recovery of impaired services and systems. During the response stage, existing and potential hazards must be removed from the affected area to allow for recovery, rehabilitation, and reconstruction to rebuild the community.

The 2008 Sichuan Earthquake: A strong earthquake struck the Sichuan province of China on 12 May 2008. It caused 87,500 deaths and led to 45.5 million wounded and 14.4 million displaced. The economic damage to 21 million buildings was estimated to be worth US\$86 billion (Hoyer, 2009). After the disaster, the direct provision of aid by the Chinese military was a significant component in the emergency response phase. The People's Liberation Army was dispatched to the affected districts within 14 minutes of the earthquake. According to official records (Mulvenon, 2008), about 150,000 military and police officers were sent across the country to assist with rescues, and they saved about 700,000 casualties from danger. A total of 100,000 medical experts were deployed across the country to assist with operations. The national government enlisted the help of 18 provinces and localities to rehabilitate the most affected areas. This response demonstrated that, in addition to having a contingency plan, dedicated and decisive central command and coordination are important for a timely response to a disaster.

The Hong Kong Red Cross dispatched its first responder personnel to Sichuan province on 13 May 2008 to examine the effects of the disaster and to prepare rescue operations (Li-Tsang and Lam, 2015). On 14 May, it sent its first medical rescue team to the county of Beichuan, the hardest hit area. It also dispatched two medical teams to the town of Yanmen and the city of Mianyang in June to assist the local health centres in providing medical assistance to those affected. A total of HK\$350 million from a Disaster Relief Fund (Chu, 2019) was injected by the Legislative Council of the Hong Kong Special Administrative Region (SAR) Government into emergency relief operations on 14 May 2008,

two days after the earthquake. As the needs of the disaster victims exceeded the capacity of existing resources, any unsolicited support was helpful in meeting the immediate demand.

New lessons are always learned from each disaster, especially in terms of how to minimise damage to property and the impacts on people. Hopefully, in future, disasters can be prevented and, when they do occur, damage can be confined.

3. Recovery

The recovery phase may take a long time—perhaps years or even decades. It involves the stabilisation of the affected areas and the restoration of all essential community functions and activities. Rehabilitation and reconstruction are also part of this stage, although the recovery of services and social provisions have to be prioritised. For instance, essential services such as the provision of food and clean water, sewage treatment, public utilities, transportation, and healthcare should be restored or reconstructed with the utmost urgency. Then, other services can follow in an orderly manner.

Rehabilitation

Rehabilitation focuses on helping individuals, communities, businesses, and organisations to return to normal operations or to a “new normal”, depending on the impacts of the disaster. There are medium- to long-term actions that can be undertaken to help people affected by disasters to resume their normal activities (Ha et al., 2019). This work is extremely demanding and difficult for the government and professional bodies involved, so they have to plan ahead. Ideally, a disaster risk reduction component should be included in their rehabilitation strategy. Knowledge, skills, and experience are key factors that can help the victims get back to their normal lives, regardless of whether they have to adjust to new ways their body functions or new ways of living. Financial resources are needed for staffing, equipment, and supplies, such as prostheses and technology-assisted devices. More details of this process are available in the first few chapters of this book.

The 1999 Odisha Super Cyclone: In October 1999, a super cyclone wreaked havoc on the Orissa coast, on the east coast of India, killing 9,885