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# Introduction to Disaster Medicine

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Throughout history, emergency medical responders have cared for the victims of disaster. As in other areas of disease and injury, medical personnel assume the responsibility of providing care to patients with illness or injury resulting from the catastrophe. Unlike other areas of medicine, however, the care of casualties from a disaster requires the healthcare provider to integrate into the larger, predominantly non-medical multidisciplinary response. This demands a knowledge base far greater than medicine alone. To operate safely and efficiently as part of a coordinated disaster response, either in a hospital or in the field, an understanding of disaster management principles is necessary.

In the mid-1980s, disaster medicine began to evolve from the union of disaster management and emergency medicine. Although Disaster Medicine is not yet an accredited medical subspecialty, those who practice it have been involved in some of the most catastrophic events in human history. Practitioners of present day disaster medicine have responded to the aftermaths of the tsunami in southeast Asia,<sup>1</sup> hurricane Andrew,<sup>2</sup> the Indian earthquake,<sup>3</sup> the Madrid train bombings,<sup>4</sup> and the World Trade Center attack,<sup>5</sup> to name a few. During the past several decades, the first applications of basic disaster medicine principles in real-time events have been carried out, and as demonstrated recently by the 2004 tsunami in southeast Asia, there is sure to be continued need for such applications.

The impetus for this text grew from a realization that, as the specialty of emergency medicine grows, emergency physicians must take ownership of this new field of disaster medicine and ensure it meets the rigorous demands put upon it by the very nature of human disaster. If we are to call ourselves disaster medicine specialists and are to be entrusted by society to respond to the most catastrophic human events, it is imperative that we pursue the highest level of scholarly knowledge in this very dynamic area. Until there is oversight from a certifying board, it is our responsibility to the public we serve to maintain this high level of excellence.

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## THE DISASTER CYCLE

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Because disasters strike without warning in areas often unprepared for such events, it is essential for all emergency services personnel to have a foundation in the

practical aspects of disaster preparedness and response. As is discussed in other chapters throughout this text, emergency responders have an integrated role in disaster management. All disasters follow a cyclical pattern known as the *disaster cycle* (Fig. 1-1), which describes four reactionary stages: preparedness, response, recovery, and mitigation/prevention. Emergency medicine specialists have a role in each part of this cycle. As active members of their community, emergency specialists should take part in mitigation and preparedness on the hospital, local, and regional levels. Once disaster strikes, their role continues into the response and recovery phases. By participating in the varied areas of disaster preparation and response, including hazard vulnerability analyses, resource allocation, and creation of disaster legislation, the emergency medicine specialist integrates into the disaster cycle as an active participant. A thorough understanding of the disaster medicine needs of a community allows one to contribute to the overall preparedness and response mission.

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## NATURAL AND MANMADE DISASTER

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Over the course of recorded history, natural disasters have predominated in frequency and magnitude over manmade ones. Some of the earliest disasters have caused enormous numbers of casualties, with resultant disruption of the underlying community infrastructure. *Yersinia pestis* caused the death of countless millions in several epidemics over hundreds of years. The etiological agent of bubonic plague, *Y. pestis* devastated Europe by killing large numbers of people and leaving societal ruin in its wake.<sup>6</sup> As of this writing, there is fear of an impending avian influenza pandemic that may be worldwide in scale.<sup>7</sup> Influenza and severe acute respiratory syndrome (SARS) have proven in recent years that, despite the passage of time and the great advances in medicine, the world continues to be affected by the outbreak of disease. Further, diseases that have been eradicated, such as smallpox, now have the potential of being reintroduced into society, either accidentally from the few remaining research sources in existence or by intentional release. Such an event could be devastating, as the baseline intrinsic immunity

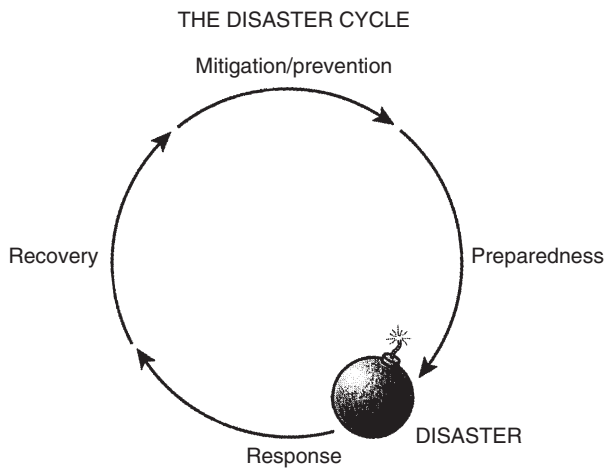


FIGURE 1-1. The disaster cycle.

the world population had developed during the natural presence of the disease has faded over time, putting much larger numbers of people at risk. Finally, with the advent of the airliner allowing rapid travel to any part of the world, the bloom effect of an outbreak is much harder to predict and control. Disease outbreaks that were previously controlled by natural borders, such as oceans, no longer have those barriers, making the likelihood of worldwide outbreak much greater now than it was hundreds of years ago.

In addition to epidemics, with each passing year natural disasters in the form of earthquakes, floods, and deadly storms batter populations. One need only to remember the destruction in terms of both human life and community resources caused by the Indian Ocean earthquake and subsequent tsunamis of 2004 to understand the need for preparedness and response to such natural events. Considering the earthquake that caused the tsunami occurred hours before the devastation, it is difficult to understand how today's advanced society, able to travel far into space among other great achievements, was unable to detect one of the most deadly natural events in recent history. The realization that disaster can strike without warning and inflict casualties on the order of the 2004 tsunami, despite our many technological advances, serves as a warning that mitigation, preparedness, and response to natural disaster must continue to be studied and practiced vigorously.

Today, the possibility of terrorist attack threatens populations across the globe. Both industrialized and developing countries have witnessed some of the most callous and senseless taking of life, for reasons not easily fathomed by civilized people. It is unusual to read a newspaper, listen to radio, or watch television news reports without learning of a terrorist attack in some part of the world. These attacks are so frequent that society has become almost numb to them. Today, an event such as a car bombing may be relegated to a side report on a daily newscast. The commonplace nature of a terrorist attack in modern society ensures it is unquestionably something that will continue long into the

future and will very likely escalate in scale and frequency.

The multilayered foundation on which ideological belief evolves into violent attack is beyond the scope of analysis this book ventures to undertake. These ongoing events do demonstrate, however, that the principles studied in the field of disaster medicine must include those that are designed to prepare for and respond to a terrorist attack. Because there are very intelligent minds at work designing systems to bring disaster on others, equally there must be as robust an effort to prepare for and respond to those disasters. Such response involves the deployment of law enforcement, evidence collection, and military personnel and equipment, which are typically not seen in the response to a natural disaster. The integration of these unique assets into the overall response is essential for the success of the mission. The disaster medicine specialist must have a thorough understanding of the role of each.

## DEFINING DISASTER

A thorough discussion of disaster preparedness and response must be predicated on a clear definition of what, in fact, constitutes a disaster. Used commonly to describe many different events, disaster is not easily defined. One of the earliest documented testaments to such an event is that of the great flood, reported in several writings, including the *Bible*. This flood is described as covering vast areas of land in the most populated part of the ancient world. Such a flood would have killed millions of people and destroyed vast areas of inhabited land. This surely would fit the definition of a disaster. Similarly, the Indian Ocean tsunami in 2004, killing well over 200,000 people, would also meet the criteria for disaster. However, a 2005 bus crash in the Baharampur district of India that killed 48 people has also been called a disaster. Likewise, the 2003 explosion of the space shuttle Columbia on re-entry into Earth's atmosphere that killed the crew of seven astronauts onboard has often been referred to as the Columbia Disaster in the lay press. How can an event resulting in the loss of seven people be placed in the same category as one that kills hundreds of thousands? Herein lies the paradox of disaster. What is it? Who defines it and by what criteria?

It is difficult to dispute that an event causing thousands of casualties should be considered a disaster, but let's analyze why that is the case. What is it about the sheer number of dead and injured that allows the event to be called a disaster? In terms of medical needs, it is simply because there is no healthcare system on Earth that can handle that number of casualties. Therefore, an event of such magnitude is a disaster because it has overwhelmed the infrastructure of the community in which it occurred. Following this logic, we can then also make the statement that any event that overwhelms existing societal systems is a disaster. This definition is close to the United Nations Disaster Management Training Programme's (UNDMTP) definition of disaster<sup>8</sup>:

A disaster is a serious disruption of the functioning of a society, causing widespread human, material or environmental losses which exceed the ability of the affected society to cope using only its own resources.

A similar definition is used by the World Health Organization (WHO). By applying these definitions, one can understand how an event in a rural area with 10 to 20 casualties may also be considered a disaster because the limited resources in that area may prevent an adequate response without outside assistance.

The widely accepted UNDMTP and WHO definitions of disaster justify describing both the 2004 tsunami and the 2005 bus accident as disasters. But what about the space shuttle Columbia destruction on re-entry? Clearly this definition does not allow one to justify the use of disaster in describing that horrific accident. This brings to light a discrepancy in how disaster specialists and the lay public term events. The Columbia accident, as an example, does not meet any accepted criteria of disaster. It was, however, an exceedingly tragic event, seen by millions on television as it was unfolding. It was tragic by the word's very definition in the *Cambridge Dictionary*: "A very sad event, especially one involving death or suffering." Public perception of such events may cause this misnomer, with a tragic incident being termed a disaster. Much like disaster, tragedy can also have a profound and lasting effect on society, especially a tragedy that is widely viewed through modern media outlets. This text, however, will follow the UNDMTP and WHO definitions when discussing disaster.

## DISASTER MEDICINE

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Disaster medicine is a discipline resulting from the marriage of emergency medicine and disaster management. The role of medicine, in particular emergency medicine, in disaster response has been clearly defined throughout history. Responsibility for the care of the injured from a disaster has been borne by the emergency specialist. Therefore, disaster medical response, in its many forms, has been around for thousands of years. Whenever a disaster has struck, there has been some degree of a medical response to care for the casualties. In the United States, much of the disaster medical response has followed a military model, with lessons learned through battlefield scenarios during the last two centuries.<sup>9</sup> The military experience has demonstrated how to orchestrate efficient care to mass casualties in austere environments. It does not, however, translate directly into civilian practice. For instance, scenarios encountered on the battlefield with young, fit soldiers injured by trauma are vastly different from those encountered in a rural setting, where an earthquake may inflict casualties on a population with baseline malnutrition or advanced age. With this realization came the need to create disaster medicine as an evolution from the military practice. This recent organization of the medical role in disasters into a more formalized specialty of disaster medicine has enabled practitioners to further define their role in the overall disaster preparedness and response system.

Disaster medicine is truly a systems-oriented specialty. There is no "disaster clinic." There are no practitioners who leave home in the morning intent on seeing disaster patients. Disaster medical care is often thrust upon the practitioner and is not necessarily something that is sought out. The exception to this is the medical specialist who becomes part of organized (usually federal) disaster team, such as a Disaster Medical Assistance team (DMAT). In this case, one may be transported to a disaster site with the intention of treating the victims of a catastrophic event. In all other circumstances, however, the disaster falls on an unsuspecting emergency responder who is forced to abandon his or her normal duties and adopt a role in the overall disaster response.

Unlike the organized disaster team member, if an emergency provider treats casualties from disaster, it will most likely be as a result of a disaster event that has occurred in his or her immediate area. Because of the random nature of disaster, it is not possible to predict who will be put into that role next. Therefore, it is imperative for all who practice in emergency health services to have a working knowledge of the basics of disaster medicine and disaster management. In addition, especially with the recent escalation in perceived and real terrorist threats, there are a host of possible attack scenarios, which may involve exotic chemical, biological, or nuclear agents and modalities. Most clinicians will have a very limited knowledge of many of these agents, so it is therefore important to educate our potential disaster responders on their specifics.

The field of disaster medicine involves the study of subject matter from multiple medical disciplines. Disasters may result in varying injury and disease patterns, depending on the type of event that has occurred. Earthquakes can cause entrapment and resultant crush syndrome; tornadoes may cause penetrating trauma from flying debris; and disease outbreak, either natural or intentional, can result from many different bacteria, viruses, and fungi. Because of the potential variability in casualty scenarios, the disaster medicine specialist must have training in the many injury and illness patterns seen in disaster victims. Even though the expanse of knowledge required is vast, the focus on areas specifically related to disaster medicine allows the science to be manageable. The study of disaster medicine should not be undertaken without prerequisite medical training. A disaster medicine specialist is always a practicing clinician from another field of medicine first and a disaster specialist second. By integrating these many disciplines, one is prepared for the variety of injury and illness patterns that may be faced.

Finally, disaster medicine presents unique ethical situations not seen in other areas of medicine. Disaster medicine is predicated on the principle of providing care to the most victims possible as dictated by the resources available and by patient condition and likelihood of survival. Disaster triage involves assigning patients into treatment categories based on their predicted survivability. This triage process may dictate that the most severely injured patient not be given medical care but rather it be provided to a less critically injured patient.

To the best of his or her ability, the triage officer must make a determination as to whether, in the environment of the specific disaster and the availability of resources, a given patient has a significant probability of survival or does not. If it is the latter, disaster triage principles mandate that care be given to the patient with a higher likelihood of survival. This basic disaster triage principle can have a profound psychological impact on the care provider. As a physician, one is trained to render care to the sick and to not leave the side of a needy patient. To deny care to a critically ill or injured patient can be one of the most anxiety-provoking tasks a disaster medicine specialist performs.

The unique and ever-changing circumstances under which disaster medicine specialists operate mandate the continued evolution and vigorous pursuit of academic excellence in this new specialty. A comprehensive approach that unifies medical principles with a sound understanding of disaster management procedures will yield a well-rounded and better-prepared disaster responder. If emergency medicine providers around the world can develop a basic understanding of the fundamental principles of this specialty, great advances in the systems included in the disaster cycle will surely follow. The more widely dispersed this knowledge becomes, the better prepared we are as a society to respond to the next catastrophic event.

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