

Disaster medicine

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Key-words. Disaster; natural disaster; cultural disaster; collective ethics

Abstract. *Disaster medicine.* Once we define the characteristics of both a disaster in general and specific disaster categories, the unique aspects of disaster or emergency management and disaster medicine become much easier to understand. The cornerstone of disaster medicine has an ethical aspect, namely how, as medical professionals, we must move from our daily practice in which we employ almost unlimited resources as required by each patient to a collective ethics situation in which a limited set of resources must be used to maximize the number of victims treated, so as to reach an optimal general outcome.

Introduction

Before discussing disaster medicine, it is of utmost importance to first define what a disaster is, as seen through the eyes of a medical professional. To understand the necessary specific adaptations of a basic medical approach in a disaster situation, we must first explain and clarify the different kinds of disasters and their specific characteristics. In a next part, disaster medicine will be described in general terms, and its similarities and differences as compared to emergency medicine will be discussed. The more operational aspects of disaster medicine will be further explained in the next chapter. Finally, disaster medicine as a science will be discussed briefly.

Definition of a disaster

Many definitions of a disaster exist that depend on the functional approach used. A disaster can be understood as the amount of damage an event can produce. Damage can be of materials or possessions, individuals or societies. Concerning individual damage, a victim can suffer somatic, psychological or social damage. In addition, identity loss can also

occur in particular disasters.¹ The United Nations defines a disaster as “a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources.”² In this UN definition, economic and environmental damage are notably included. From most definitions and, more specifically, medically oriented definitions, one can conclude that a disaster creates an imbalance between needs and limited resources. The basics of disaster management and medicine consist of measures to prevent or adequately respond to this potential or existing imbalance.³ Sometimes the term “major incident” is used to describe damaging events for which resources are available but the key management issue is that they must be mobilized to the right place within an acceptable time frame. From a management perspective, it is important to draw a distinction between a disaster and a major incident.

Thus, a society should draw up an inventory of all existing risk factors that could induce an incident or disaster and estimate, through a hazard vulnerability assessment, the potential damage associated with

each risk factor. In addition, the incidence or the chance of such risk factors developing into an incident should be estimated.⁴

In a next step, a disaster cycle should be drafted for each risk, including a prevention and mitigation phase to reduce the risk, a preparedness phase outlining how to prepare if a response is required, a response phase and a recovery phase.⁵

Categorization of disasters

Although categorization may be artificial, it can aid our understanding of how to draw up the above-mentioned disaster cycles. The initial categorization draws a distinction between natural disasters (acts of God) and cultural disasters (man-made incidents). Some will state that a natural disaster only fulfils the definition given that humans created a society at a specific location. However, natural disasters are characterized by the destruction of a large region, mostly disrupting infrastructure and reducing the potential for professional aid. By contrast, man-made or human disasters cover a much smaller impact area and are usually limited over time concerning the disaster cycle.⁶

Human disasters can be further categorized as:

1. Sociological disasters – war, terrorist attacks, civil disobedience and mass crimes are some examples. Recent terrorist attacks in Paris and Brussels are some painful examples of how an ideological belief can evolve into violence against a society.⁷ Disaster management can guide reactions so as to minimize the effects of such violence, but will never eradicate the root causes of this ideological fundamentalism.

2. Technological disasters are the more common expected incidents in our society. Some examples include severe incidents in industrial plants, traffic disasters (plane, boat, road), infrastructure collapses and chemical, biological, radiological, nuclear and high yield explosives (CBRNe) incidents. Most disaster response plans are designed to respond to such incidents and most of these events constitute major incidents rather than real disasters. The principles of incident or disaster planning for technological incidents are not always applicable to other incidents or disasters. However, as these incidents are more common in our society, most educational programmes on disaster medicine initially teach these principles.

3. Environmental disasters are often the result of a technological or natural disaster that was

insufficiently managed and not kept within expected damage limitations. The Fukushima incident is a typical example of this category of disaster.⁸

Natural disasters can be categorized as:

1. Geological disasters, such as avalanches, earthquakes or volcano eruptions, resulting in an abnormal movement of materials.

2. Hydrological disasters resulting in an abnormal movement of water, such as floods or tsunamis.

3. Meteorological disasters can lead to damage through abnormal movements of water or materials, such as cyclones, storms or tornadoes, but can also cause damage through especially high or low temperatures, or drought.

4. Fire disasters, such as large forest fires, can disrupt a society. Geological, hydrological, meteorological or fire disasters will only be considered as real disasters if they disrupt a society or many victims are involved.

5. Health disasters are well known throughout history.⁹ *Yersinia Pestis* epidemics have caused the deaths of countless numbers over the centuries. More recently, Ebola and MERS have posed potential risks. The mobility of people using all kinds of transportation makes the spread of pathogens much easier in modern times.

Other parameters

In addition to the cause of the incident or disaster, other parameters are of importance to shaping our response.

The first group of parameters concern the environment of the incident. Geological factors, whether the area is urban or rural, availability of infrastructure and, in cases of industrial plant incidents, whether relevant resources or structures are available are all important parameters. In addition, climatic circumstances, such as outdoor temperature and exposure to sun, cold, rain or snow, are important parameters to take into account during a disaster response or when formulating the preparedness phase.

The duration of the incident and, if limited to one day, whether it takes place in the day- or night-time is a second important parameter.

A third group of parameters relate to the presence of a remaining risk or additional other risks. For instance, in the case of a terrorist bomb attack, rescuers must be aware that terrorists may also target them with explosives set to detonate during

the search and rescue process. Other examples include the possible presence of trucks containing dangerous chemicals within a pile-up accident or the terrible nuclear disaster that was induced by the tsunami that hit Fukushima.⁸

A fourth group of important parameters are the expectation of specific injuries and disease patterns. One may have daily experience with severely injured patients in a trauma centre, but crush lesions following an earthquake or blast injuries following a terrorist bombing are of another degree and require specific initial and subsequent therapy. In addition, an epidemic involving highly contagious microorganisms may demand a cohort set-up rather than spreading the patients over as many hospitals as possible.⁹

Disaster medicine

Disaster medicine has its roots in military medicine and the union of disaster or emergency management and emergency medicine.¹⁰ Over the years, it has been further complemented by other fields of medicine, such as preventive medicine and infectious diseases or rehabilitation medicine, and aspects of other sciences, such as risk assessment and reduction from engineering, epidemiology and social sciences. However, the question remains as to whether an emergency physician is also an appropriate disaster medicine physician.¹¹ To answer this question we will compare both disciplines. Both disciplines involve medical and management components.

In emergency medicine, it is usually the patient, his/her family or another health professional who decides that a patient needs urgent care. Emergency physicians are exposed to emergencies involving all organs and systems in all age groups. Additionally, the patient is in fear and experiences social disorganization, expecting timely and maximal medical care. From a management perspective, emergency medicine is the paradigm case of “unplanned care”. Neither the number of admitted patients nor the severity or complexity of their needs can be predicted and used to plan the space, materials and personnel that will be needed at any given time. These factors play an important role in the organization of emergency medical services and the emergency department. Combining these medical and management aspects, emergency medicine must establish a system and structure that

makes it possible to identify and treat life-, organ- or limb-threatening conditions in a timely manner by prioritizing the diagnostic workup and initial therapy. To do so, emergency physicians must have access to all available diagnostic and therapeutic interventions, including critical care. The main goal is to return each patient to a stable biological and psychosocial homeostasis as quickly as possible. This means that an emergency physician must be trained in process-oriented, timely and priority-based thinking. Emergency physicians must also collaborate in a team with other healthcare professionals or responders such as the police or firefighters using standard operating procedures and protocols.

In disaster medicine, concerning the medical component, quite often similar pathologies are presented and treated though often involving specific risks, lesions or diseases as mentioned above, and only specific or basic therapeutic interventions can be used.¹⁰ The aim is to minimize human fatalities while reducing the risk of long- and short-term physical and psychological complications. Concerning the management component, process-oriented and priority-based thinking are also important aspects of disaster medicine. However, the most essential aspect is the unique ethical situation according to which one must switch from an individual to a collective ethical approach.¹

Thus, the distinction between emergency and disaster medicine is more than merely a matter of degree. Adapted diagnostic and therapeutic techniques, greater attention to public health and limited resources with which to treat a large group of patients requires an alternative ethical and organizational approach. The cornerstone of disaster medicine is how, as medical professionals, we can move from our daily practice in which we employ almost unlimited resources as required by each patient to a collective ethical approach according to which a limited set of resources must be used to maximize the number of victims treated, so as to reach an optimal general outcome.¹² Specific knowledge, skills and competencies are also required, indicating that, although there are similarities with emergency medicine, specific training in these aspects is mandatory for an emergency physician to be capable of acting efficiently and appropriately in various disaster situations.⁵

Disaster medicine as science

In any medical discipline, knowledge increases via a scientific approach. Disaster medicine as a science is more descriptive than analytical. Research can rarely employ quantitative methods and the use of randomized controlled trials is practically and ethically impossible. The limited knowledge that exists is based on analytical statistics, and evidence-based disaster medicine is as difficult as pre-hospital medicine.¹³ A major consequence is that mistakes are often repeated. Even though the science is mainly descriptive, documentation of decisions based on limited information during disaster management is rarely sufficient to evaluate coordination and command. However, essential decisions are taken despite sparse and seemingly insufficient information. Setting standards for evaluation and research in disaster medicine has been proposed using an Utstein template but, although this template exists, minimal implementation has been achieved due to the lack of research resources available during significant critical incidents.¹⁴ Measurable performance indicators must be further developed, implemented in disaster management training and used in real incidents.¹⁵ IT systems are being developed and implemented to support simultaneous decision-making and documentation.

References

1. De Boer J. An introduction to disaster medicine. *Eur J Emerg Med.* 1995;13:211-216.
2. United Nations International Strategy for Disaster reduction. Available at: www.unisdr.org. Accessed September 12, 2016
3. Lennquist S. The importance of maintaining simplicity in planning and preparation for major accidents and disasters. *Int J Disast Med.* 2004;2(1-2):5-8.
4. Chang JC. Community hazard vulnerability assessment. In: Ciottone GR Ed. *Disaster Medicine*. Elsevier, Philadelphia, 2016:131-135.
5. Ripoll Gallardo A, Djalali A, Foletti M, Ragazzoni L, Della Corte F, Lupescu O, Arculeo C, von Arnim G, Friedl T, Ashkenazi M, Fisher P, Hreckovski B, Khorram-Manesh A, Komadina R, Lechner K, Stal M, Patru C, Burkle FM, Ingrassia PL. Core competencies in disaster management and humanitarian assistance: a systematic review. *Disaster Med Public Health Prep.* 2015;9(4):430-439.
6. Benedek DM, Fullerton C, Ursano RJ. First responders: mental health consequences of natural and human-made disasters for public health and public safety workers. *Annu Rev Public Health.* 2007;28:55-68.
7. Hirsch M, Carli P, Nizard R, Riou B, Baroudjian B, Baubet T, Chhor V, Chollet-Xemard C, Dantchev N, Fleury N, Fontaine JP, Yordanov Y, Raphael M, Burtz CP, Lafont A; health professionals of Assistance Publique-Hôpitaux de Paris (APHP). The medical response to multisite terrorist attacks in Paris. *Lancet.* 2015;386(10012):2535-2538.
8. Hasegawa A, Tanigawa K, Ohtsuru A, Yabe H, Maeda M, Shigemura J, Ohira T, Tominaga T, Akashi M, Hirohashi N, Ishikawa T, Kamiya K, Shibuya K, Yamashita S, Chhem RK. Health effects of radiation and other health problems in the aftermath of nuclear accidents, with an emphasis on Fukushima. *Lancet.* 2015;386(9992):479-488.
9. Ligon BL. Plague: a review of its history and potential as a biological weapon. *Semin Pediatr Infect Dis.* 2006;17(3):161-170.
10. Wolfe RE. Role of emergency medicine in disaster management. In: Ciottone GR Ed. *Disaster Medicine*. Elsevier, Philadelphia, 2016: 20-26.
11. Shen W, Jiang L, Zhang M, Ma Y, Jiang G, He X. Very serious and non-ignorable problem: crisis in emergency medical response in catastrophic event. *Emerg Med Australas.* 2015;27(6):573-579.
12. Howe EG. How can careproviders most help patients during disaster? *J Clin Ethics;* 2011;22(1):3-16.
13. Auf der Heide E. The importance of evidence-based disaster planning. *Ann Emerg Med;* 2006;4751°:34-49.
14. Debacker M, Hubloue I, Dhondt E, Rockenschaub G, Rüter A, Codreanu T, Koenig KL, Schultz C, Peleg K, Halpern P, Stratton S, Della Corte F, Deloos H, Ingrassia PL, Colombo D, Castrèn M. Utstein-style template for uniform data reporting of acute medical response in disasters. *PLoS Curr* 2012;4:e4f6cf3e8df15a.
15. Rüter A, Örtenwall P, Wikström T. Performance indicators for major incident medical management – a possible tool for quality control? *Int J Disast Med.* 2004;2(1-2):52-55.

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