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Natural Disasters and Medical Help

Siniša Franjić

Independent Researcher, Croatia.

***Corresponding Author:** Siniša Franjić, Independent Researcher, Croatia.*

Abstract

Natural disasters are caused by natural forces and manifest as earthquakes, fires, floods, droughts, avalanches, storms, landslides, hurricane winds, volcanic eruptions, etc. One of the common characteristics of natural threats related to most of them is the suddenness of their occurrence, though through scientific advances and modern technology, can be already predicted the occurrence of some of the natural disasters by place and time. The term catastrophe signifies a state of disruption to daily routine with an emphasis on great human victims and enormous material damage.

Keywords: *Natural Disaster, Disaster Medicine, Medical Professionals, Firefighters.*

Introduction

More than 4 million people worldwide have lost their lives and hundreds of millions have suffered due to natural and man-made disasters during the past 30 years [1]. The dollars lost in damages and reconstruction costs are staggering. Hundreds of billions have gone to rebuild the infrastructure and to replace the personal property damaged or lost as a result of these disasters. Ongoing assistance may be required many years after the disasters to sustain and reconstruct the lives of those affected.

Disaster medicine and prevention is a system of study and medical practice encompassing the disciplines of emergency medicine and public health. The multidisciplinary nature of disaster planning and response has traditionally resulted in various definitions of disasters and events that cause mass casualties.

During disaster events, people may be without power, shelter, communication, food, and water [2]. Emergency response capabilities can quickly become overwhelmed due to the magnitude of the damage. Injured members of the community may be unable to find transportation to healthcare facilities as the local emergency medical services (EMS) may not be able to gain access to victims or may be overwhelmed by the sheer mass of those in need. Healthcare facilities may be damaged directly during the impact and be unable to provide emergency services, or they may need to be evacuated. Those healthcare facilities that remain operational soon become inundated with more arriving patients than they have the staff or space to manage.

Climate

The Earth's climate has experienced unprecedented warming over the past few decades [3]. The average global surface temperature has risen by 0.85 °C during the period of 1880– 2012, and the last three decades (1983–2012) were the warmest 30 years over the last 1400 years in the northern hemisphere. As per climate model results, the global surface temperature is expected to further rise by 1–4 °C on the average by the end of this century relative to the period of 1986–2005, strongly depending on the greenhouse gas emission pathways. The changes in the climate systems have aggravated modifications in functioning of ecosystems and led to occurrence of many extreme events across the globe. The frequency of high temperature events, warm days, and nights has increased, while low temperature events, cold days, and nights have declined across the globe. Extreme rainfall events (floods and droughts) have increased in many parts of the world, while the number of rainy days has declined.

The model results suggest that due to future climatic warming, related extreme events will increase during

this century. High temperature events are expected to increase, whereas the number of cold days and nights will decline. The frequency of heavy rainfall events is expected to increase, as well as wildfires due to increased evaporation, transpiration, and drought spells in future. As a result of temperature increase sea level will rise, which may at a later stage lead to global cooling as well. Besides extreme climate events, the major impacts of the climate change include changes in the microclimate and weather patterns, worldwide glacier recessions and associated sea level rise and coastal flooding, sedimentation in river basins, glacial lake outburst floods, changes in the vegetation patterns and phenology, agricultural yield, food security, and damage and loss to populations and economies.

Earthquakes

An earthquake is the most likely large-scale event in the United States [1]. Earthquake intensity is commonly measured by the Richter scale, a logarithmic scale that measures the intensity of seismic waves. An earthquake of 2.0 magnitude is barely felt, whereas an 8.0-magnitude event is greatly destructive. There have been six major earthquakes greater than 8.0 on the Richter scale in the history of the United States. An earthquake of a given magnitude may produce varying amounts of destruction, depending on a complex interaction of many factors, including the type of ground underlying a structure, the degree of ground failure (eg, landslide, soil failures), and the construction quality of overlying structures.

Injuries are most often due to structural collapse, the degree of which will also depend heavily on local structural engineering standards. Illness also occurs as a result of disruption of existing community infrastructure (eg, food supply, power, sanitation, ongoing support for persons with chronic disease). Predictably, the patterns of injury seen among casualties include severe orthopedic, neurologic, and thoracic crush injuries, lacerations, tetanus and dysentery infections, environmental exposure, and exacerbations of chronic medical problems.

Tropical Cyclones

Tropical cyclones (hurricanes in the United States and Atlantic, typhoons in the eastern Pacific, tropical cyclones elsewhere) are a circulating mass of clouds, rain, and wind around a clear central area of extreme low barometric pressure [1]. They occur most commonly in the late summer months.

The intensity of tropical cyclones is rated on a 5-point scale. For hurricanes approaching the United States, this information is available from the National Weather Service, which can also provide information about a storm's probable path. Damage is due to high winds, which can exceed 150 mph, storm surges, tornadoes, and inland flooding. Of these four, inland flooding causes more property damage and loss of life.

Casualties may be caused by trauma from flying debris or struc Annually in the United States, tornadoes and severe thunderstorms are the most common cause of death due to natural disasters [1]. Approximately 100,000 severe storms (eg, involving thunder, high winds, and hail) occur each year in the United States, including 1000 tornadoes. Most commonly affected are the states in "tornado alley," the area between the Rocky Mountains and Appalachian Mountains. No state is completely free of the risk of tornado. Tornadoes usually occur during the summer months and during late afternoons. Only about 3–4% of all tornadoes produce injury, and most deaths occur in a small number of highly destructive events. Casualties are related to trauma from structural collapse, flying debris, or being knocked to the ground or thrown. Head injuries, crush injuries, fractures, contusions, and lacerations are common.

As with all disasters, secondary illness and injury may occur, although tornadoes most commonly tend to produce random, isolated groups of casualties wherever they touch down, rather than diffuse area-wide casualties and destruction to community infrastructure.

Floods

Floods can be divided into riverine floods, hurricane (storm) flooding, flash floods, and tsunamis [1]. Riverine floods are typically seasonal and result from excessive rains or snow melts that lead to rivers overflowing their banks in a floodplain area. Flash floods occur in areas where rainfall produces surface water that exceeds the runoff or absorptive capacity of the soil. Storm flooding as a result of hurricanes is covered above. Tsunamis are caused by earthquakes or volcanic eruptions at sea. Rarely, flooding can be caused by failure of a dike or dam, usually due to heavy rains.

In the United States, the number of deaths each year from floods is small and sporadic. Property damage can be considerable, as are secondary effects on crops, sanitation, and vector-borne infections. When casualties occur, they are usually due to drowning. Mitigation (eg, through watershed engineering projects and limiting development on floodplains) and early warning are the most effective means of reducing deaths.

Tsunamis or tidal waves occur during sudden geologic events occurring at sea, such as earthquakes and volcanic eruptions. The tsunami will be worse if the epicenter of the seismic event resides in relatively shallower water. The giant wave of water may travel from the epicenter at hundreds of miles per hour. The onset is often heralded by a sudden ebb of water that exposes the seafloor and is followed in minutes by a wall of water that may rise to 100 ft. Massive damage occurs to the shore and structures; casualties are due to drowning. Mitigation through early warning is the most effective means of reducing casualties. Sea walls and locating structures on high ground can provide some additional relief.

Volcanos

Volcanoes are channels of molten rock (magma) from deep in the earth that vent to the surface in one of several forms [1]. They may cause eruptions of molten rock (lava) or spew ash and debris. Volcanoes tend to be localized to the boundaries of tectonic plates (eg, the Pacific Rim). Injury is most commonly due to falling debris, collapse of structures under the weight of ash, being buried in mudslides or lava flows, or toxic effects of gases (eg, carbon dioxide, hydrogen sulfide). Effects on agriculture and property can be extensive. In many cases, early warning, although imprecise, can allow evacuation and mitigate casualties.

Winter Storms

A winter storm can range from a moderate snow over a few hours to blizzard conditions with blinding wind-driven snow that lasts several days [1]. Some winter storms may be large enough to affect several states, while others may affect only a single community. Many winter storms are accompanied by sustained low temperatures and heavy winds.

Frostbite and hypothermia are of main concerns with trapped motorists, homeless people, and those trapped at home, without utilities or other services. Incorrect venting of heating devices and/or generators is a major cause of carbon monoxide poisoning during disasters. Fires are common with use of inappropriate alternative heating devices. Of course, trapped without heat or proper clothing, people may suffer hypothermia or cold injuries. Property damage may occur due to pipeline freezing with subsequent building flooding, structural overload with snow and/or ice, and falling tree limbs or trunks. Automobile accidents are common.

Pandemics

A disease epidemic occurs when there are more cases of that disease than normal [1]. A pandemic is a worldwide epidemic of a disease. A pandemic may occur when a disease appears against which the population has little or no immunity. With the increase in worldwide transport and urbanization and crowded conditions in some countries, epidemics due to a new disease or novel organism are more likely to occur around the world. Pandemics can be either mild or severe in the illness and death they cause, and the severity of a pandemic can change over the course of that pandemic.

Disaster Medicine

Disaster medicine is a system of study and medical practice associated primarily with the disciplines of emergency medicine and public health [4]. Disaster medicine is concerned with the health and medical and emotional issues of disaster casualties. To provide care efficiently, however, the health careprovidermust be familiar with several elements of disaster management, including planning, mitigation, assessment, response, and recovery. Disasters may destroy or disable the medical infrastructure of a given area, making access to routine health care impossible. Infectious diseases endemic to the population may increase in frequency, mandating the deployment of epidemiological surveillance and intervention programs. Nutritional problems that necessitate evaluation and intervention can surface, particularly during long-duration complex disasters. Long-term and short-term emotional and psychiatric conditions may plague the disaster-stricken community, requiring counseling and well-planned support systems.

DNA

DNA may be obtained also from some personal effects bearing biological material [5]. For that reason, a DNA specialist should be consulted before personal

belongings are cleaned for photographing, cataloging, and returning to families.

Comprehensive X-rays documentation is made of appropriate cases to identify commingled remains, artifacts (jewelry, evidence, etc.) imbedded in human tissue, and evidence of antemortem skeletal injury, surgeries, or anomalies. Such features may aid in identification by correlation with antemortem medical records.

Human remains that lack typical identifying features (tissues without fingerprint, dental, or anthropological material) can often be identified through DNA. For this reason, morgue processing should include a station to obtain and preserve a specimen for DNA testing from each case processed.

Following a mass fatality, the entity or organization responsible for identifying the human remains will use DNA profiling to supplement traditional methods of human identification, which include anthropology, pathology, fingerprint, and dental records [6]. While DNA is a powerful identification tool, DNA results are only part of an overall identification effort, which, depending on the condition of the human remains, also takes into account non-DNA evidence. In certain circumstances, where there is extensive fragmentation and/or decomposition of the bodies, DNA analysis may be the only method of identification. DNA analysis is often the only tool available that can be used to identify and reunite fragmented human remains.

As with other identification technologies (anthropology, fingerprints, odontology), human identification through DNA analysis is, at its most basic, a biometric technique. Like these other technologies, DNA analysis uses a characteristic specific to the unknown sample (remains) to compare to a known sample from the deceased (reference). In order to identify human remains, a DNA profile from the human remains must be "matched" to one or more DNA profiles from biological samples of known origin (reference sample). However, unlike these other comparison techniques, DNA analysis offers the additional flexibility of allowing the comparison of a profile from the unknown sample to immediate and extended family members.

DNA is a comparison science that requires one or more valid reference samples to identify remains [7]. DNA samples should be collected from the remains, appropriate family references, and direct references, such as personal items or biological specimens. Personal items may include used toothbrushes, shavers/razors, personal hygiene items, unwashed undergarments, and other suitable clothing. Biological specimens may be obtained from blood stored for elective surgery, biopsy samples, PAP smears, extracted teeth, or hair samples.

Obtaining, storing, and analyzing biological samples from both the remains and potential relatives requires special expertise and should always be undertaken by a scientific or medical expert. If the DNA samples need to be transported, the Medical Examiner should seek expert advice on the most appropriate method of preservation and transport to ensure that the security and integrity of the samples are maintained.

Hospitals and Medical Staff

A disaster is an event whose demands exceed the capacity of the available resources to respond [8]. Disasters can result in hospitals being overwhelmed by the sheer number of casualties or they may be unable to function at all. Disasters such as Hurricane Katrina and the Japanese tsunami illustrated how hospitals could be destroyed or so badly damaged as to render them unusable during a disaster and after the hazard threat had subsided. Hospitals and medical staff may thus be forced to establish and work from ad hoc facilities. Even if they remain intact, hospitals will have to operate at considerably reduced capacity as a result of infrastructure losses (e.g. damage to buildings and equipment, loss of utilities) that results in, for example, the closure of critical care facilities. Disasters can result in staff being unable (e.g. owing to impassable roads) or unwilling (e.g. owing to concerns for their safety) to work. When working in disaster contexts, staff will have to contend with working longer hours than normal, being deployed to other locations or functions, and dealing with personal loss, confusion or grief.

Hospitals and healthcare staff must be prepared for disasters arising from hazards ranging from earthquakes to pandemics to acts of bioterrorism. Meteorological and geological hazard activity can injure staff or they may be infected or contaminated by pandemic or biohazard events. Hazards also differ in their response implications. Earthquakes create a period of acute demand that can subside over a period of days but may require a longer period of caring for

those sick or injured. Pandemic influenza hazards, on the other hand, can create steadily escalating demands as more people become infected. At the same time, increasing rates of staff infection reduce staff availability. These problems can persist for several weeks or months. The task facing hospitals is complex and they must accommodate a range of events, circumstances and consequences in disaster response planning.

Hospital mitigation efforts begin with the hazard vulnerability assessment [9]. This is the guide for hospital preparedness. Each hazard is rated by hospital personnel to determine which are more likely in their region and which will have the greatest impact on sustainability. An all-hazards approach is incorporated here that allows for mitigation and preparedness efforts that will encompass many hazards rather than just focusing on one. This allows the hospital to gain preparedness at a lesser cost. That is, rather than buying one type of supplies for a hurricane disaster and a different kind of supplies for an earthquake disaster, effort is made to make the plan globally apply to as many hazards as possible. This should also apply to the plans themselves; rather than having a different plan for each type of disaster, there should be only one plan with appendices as necessary for procedures that do not lend themselves well to the all-hazards approach. This also simplifies the response effort because staff are taught only one way to perform in a disaster and do not have to stop and make a determination of which way to respond.

EMS

The evolution of the modern EMS (Emergency Medical Services) continues be a testament to our nation's ability to develop the most successful approaches to casualty mitigation and resolution of disasters in the austere environment [1]. The most critical tasks in a disaster include identification of the disaster, situational awareness, triage, and transporting to an appropriate facility.

Disaster identification may involve both prevention and surveillance. EMS plays a fundamental role in local disaster planning and education within the communities they serve. EMS interaction with all levels of governmental and nongovernmental agencies that provide the safety and health care infrastructure to communities provides a unique opportunity to cross political and territorial issues. This allows the EMS leaders to initiate community education programs and coordinated disaster training. EMS knowledge of infrastructure and geography optimizes planning for ingress, egress, staging areas, casualty collection points, and command posts.

EMS personnel should be educated in the implementation of ICS (Incident Command System) in a disaster response. Equipment, supplies, training, and protocols used in a disaster must be the same that are used during day-to-day operations to ensure familiarity and operability in severely stressful situations. Multiple military training programs have validated that in times of stress, the provider will first respond within the training provided. Scene organization is crucial to manage outside agency and Samaritan relief efforts. Plans must be practiced, reviewed, and updated to reflect lessons learned from recent disasters and training scenarios. Executive exercises and tabletop exercises must be transformed into live multiagency training exercises on a regular basis to ensure that all levels of provider have been trained in needed techniques in the disaster.

Firefighters

Describing firefighters without using the word "hero" would be tough [10]. After all, their ultimate goal is to prevent or relieve human suffering and loss. They regularly put their own lives on the line to save other lives and protect property. Much of their work is physically exhausting, mentally demanding, and highly dangerous. When a fire or other emergency strikes, they are on the scene battling flames, smoke, collapsing walls, chemical explosions, and numerous other threats. Unlike civilians, they can't evacuate the premises. They are working hard until the crisis has passed.

Behind every heroic moment, of course, are countless hours of preparation. Career firefighters are highly trained professionals. Their services are essential to every community and every stretch of land across this country.

Today, the fire service is an all-hazards response agency. Firefighters might find themselves at a trash fire and, before returning to quarters, have to render medical aid to a child who fell from her bike. If a problem or emergency is not clearly assigned to other agencies, the fire service is sent. In the twenty-first century, firefighters are on the front line of community

protection. Hazardous materials require knowledge of chemistry. Terrorism, both homegrown and domestic, requires cross-training with law enforcement. Natural threats, such as floods, storms, and earthquakes, require knowledge of emergency management.

A career in the fire service is no longer a part-time career that provides benefits and the ability to run a side business, but rather requires a full-time commitment to lifelong learning. As a group, firefighters are seen by the community as heroes who are able to treat injuries like a combat medic; mitigate spilled chemicals as a professional chemist would; defeat terrorism alongside homeland defense responders; plan for emergencies at the level of a military planner; fight every fire, and rescue all who are in danger. For all ofthese reasons, communities are very careful whom they hire for fire department openings. All applicants must go through a rigorous testing and selection process that may last a few months to a year or more, so as to select only those who are qualified and prepared for the commitment. Although physical strength is still required, firefighters today must also have the academic skills to apply mathematics and sciences. Municipalities seek candidates with all the necessary skills, but they also seek potential firefighters who are trustworthy. When all is said and done, a firefighter occupies a position in which people must trust him or her with their lives and property.

Modern firefighters are trained in the assessment and treatment of life-threatening conditions sustained by the public they serve [11]. They are responsible for stabilizing the scene of an accident or emergency situation and performing basic first aid procedures, as well as assisting pre-hospital providers. Patient assessment and basic medical treatment is essential to the role of the firefighter. Upon the arrival of the ambulance, firefighters will transmit valuable information to emergency medical technicians (EMTs) and paramedics concerning the patient's condition, chief complaints, and any medical assistance that was administered prior to their arrival. Today's firefighter is truly a multifaceted, life-saving professional.

Conclusion

The natural world can be a very dangerous place. Natural disasters occur in every part of the world that can cause damage to property, land, wildlife and even humans. Natural disaster is a major event caused by natural processes around the world. They can have devastating effects on the lives and geography of our planet. A natural disaster is considered a sudden major disruption that interrupts the normal course of life, causes casualties, greater damage to property and its loss, and damage to infrastructure and the environment, to the extent that exceeds the community's normal ability to remedy them without assistance.

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