NATURAL AND MAN-MADE EMERGENCIES: THE ROLE OF FIRST AID IN SAVING LIVES

Gafarova Jala Rahman
Doctor of Philosophy in Medicine (PhD)
Senior Lecturer, Department of Physiology, Azerbaijan State Pedagogical University, Azerbaijan

ORCID ID: 0009-0008-9426-5988

Abstract
Emergencies of natural and man-made (technogenic) origin represent acute threats to human life, public health, ecological stability, and socioeconomic infrastructure. Under conditions of sudden onset and mass casualties, professional emergency medical teams frequently face logistical delays before reaching the disaster zone. Consequently, the immediate administration of competent first aid through self-aid and mutual aid during the critical 'golden hour' becomes the decisive factor in reducing preventable mortality and severe post-traumatic complications. This extended thesis examines the modern classification of emergencies, characterizes their mechanical, thermal, chemical, radiation, and biological damaging factors, and analyzes the medical-sanitary consequences of disasters.

Keywords: *natural emergencies, man-made disasters, first aid, self-aid and mutual aid, closed mechanical injuries, mass casualties, damaging factors, disaster medicine, emergency medical response, population preparedness.*

Emergencies (ES) are critical events resulting from natural phenomena, technological accidents, or human activities that threaten human life and health, disrupt normal living conditions, and cause substantial material and environmental damage [1, 2]. Across the late twentieth and early twenty-first centuries, the frequency and severity of both natural disasters and industrial catastrophes have risen steadily due to global climate variability, rapid urbanization, high population density, and the increasing complexity of industrial, transport, and energy infrastructure [2, 3]. In any emergency scenario, immediate first aid plays a foundational role in saving lives, stabilizing physiological functions, and minimizing long-term disability among victims [4].

A defining feature of major disasters is the acute temporal gap between the moment of injury and the arrival of specialized search-and-rescue teams or professional ambulance brigades. Infrastructure damage, blocked transport corridors, communication outages, and simultaneous mass casualties routinely delay professional medical intervention [5]. Under such time-critical conditions—widely recognized in trauma and disaster medicine as the 'golden hour' and the 'platinum ten minutes'—the survival outcome of

an injured person depends directly on the timeliness, accuracy, and competence of basic first aid rendered on-site by bystanders, survivors, and first responders [4, 6].

The objective of this paper is to provide a comprehensive synthesis of the classification and destructive mechanisms of natural and man-made emergencies, evaluate their medical and sanitary consequences, and systematize core first aid interventions—with special emphasis on closed mechanical injuries and civilian preparedness.

In contemporary disaster medicine and civil defense theory, emergencies are systematically classified according to their sphere of origin, nature of the underlying physical or biological process, scale of geographical spread, severity of human and economic losses, and departmental affiliation [1, 7]. Based on the primary sphere of origin, emergencies are categorized into natural, man-made (technogenic), ecological, biological-social, social, military, and aerospace emergencies [1].

Natural emergencies arise as a result of hazardous geophysical, geological, meteorological, hydrological, and biological phenomena driven by endogenous (tectonic and volcanic) and exogenous (atmospheric and hydrospheric) forces acting upon the biosphere [1, 3].

Man-made emergencies originate from industrial accidents, engineering failures, human operational errors, or transport collisions [1, 8]. Typical categories include road, rail, aviation, and maritime transport accidents; fires and explosions at chemical, petrochemical, and mining enterprises; accidental releases of chemically hazardous substances (CHS) or radioactive materials; hydrodynamic accidents such as dam breaches; and critical failures of municipal life-support systems (power grids, water supply, and gas pipelines) [7, 8].

Regardless of whether an emergency is triggered by natural forces or technological failure, its impact on the human organism and the environment is mediated through five primary damaging factors: mechanical, thermal, chemical, radiation, and biological [5, 8]. These factors frequently act in combination (combined trauma), significantly complicating clinical presentation and pre-hospital care. Beyond direct physical harm, large-scale emergencies generate multidimensional consequences spanning medical-sanitary, psychological, social, domestic, engineering-technical, legal, demographic, genetic, and economic domains [1, 2].

Table 1. Primary Damaging Factors of Emergencies, Typical Injuries, and Immediate First Aid Priorities

Damaging Factor	Typical Emergency Sources	Dominant Clinical Injuries	Immediate First Aid Priorities

Mechanical	Earthquakes, building collapses, transport crashes, explosions	Contusions, sprains, dislocations, open/closed fractures, hemorrhage, crush syndrome	Extrication, bleeding control, immobilization, airway patency, shock prevention
Thermal	Fires, industrial blasts, volcanic lava, extreme cold/blizzards	Thermal burns (degrees I–IV), smoke inhalation, heatstroke, frostbite, hypothermia	Extinguish flames, cool burn site with clean water, sterile dressing, thermal insulation
Chemical	Chemical plant leaks, toxic spills, transport accidents with CHS	Acute inhalation poisoning, chemical burns of skin/eyes, toxic pulmonary edema	Evacuate to fresh air, respiratory protection, copious water irrigation, antidotes if available
Radiation	Nuclear power plant accidents, radiological transport incidents	Acute radiation syndrome, local radiation burns, internal radionuclide contamination	Evacuate from zone, shelter, airway/skin protection, iodine prophylaxis, decontamination
Biological	Epidemics, epizootics, post-flood sanitation breakdown	Acute infectious diseases, severe dehydration, toxic-infectious shock	Isolation of symptomatic individuals, barrier protection, rehydration, urgent medical alert

One of the defining epidemiological features of the modern era is mass traumatism among the civilian population caused by natural forces or technological accidents [5, 7]. Unlike routine clinical emergencies, disasters are characterized by suddenness, high intensity, and spatial or temporal unpredictability, which overwhelm local healthcare capacities within minutes [2, 5]. In disaster medicine, a catastrophe is defined as a sudden, fleeting event that poses an extreme threat to human life and health and creates

a severe disproportion between the urgent medical needs of victims and the available medical personnel, equipment, and hospital beds [5, 9].

The principal medical and sanitary consequences of major natural and man-made disasters encompass five interrelated phenomena [5, 9]:

Mass Emergence of Casualties with Complex Trauma: The simultaneous appearance of a large number of injured persons presenting with polytrauma, crush injuries, severe hemorrhage, burns, and acute poisonings requires immediate medical triage and staged evacuation [5, 6].

Acute Stress and Psychogenic Disorders: Survivors, witnesses, and even rescue personnel frequently develop acute stress reactions, panic, cognitive disorientation, and post-traumatic stress disorders (PTSD), which can impede self-rescue and complicate crowd management in the affected zone [3, 9].

Disorganization of Local Healthcare Management: Physical destruction of hospitals, clinics, pharmacies, and ambulance stations, combined with injuries among medical staff and disruption of power and water utilities, severely impairs local medical command and clinical care delivery [2, 9].

Irreversible Human and Material Losses: High primary mortality at the epicenter and secondary mortality during delayed evacuation result in substantial demographic losses alongside the destruction of critical medical infrastructure [5, 7].

Deterioration of the Sanitary-Hygienic and Epidemic Situation: Damage to sewage and drinking water networks, accumulation of debris and organic waste, mass displacement of populations into temporary shelters, and proliferation of disease vectors create heightened risks of outbreaks of enteric, respiratory, and wound infections [2, 9].

First aid represents a complex of urgent, basic life-saving measures performed directly at the site of injury prior to the arrival of professional medical personnel [4, 10]. In emergency zones, first aid is predominantly delivered through self-aid (actions taken by the victim to preserve their own life) and mutual aid (assistance provided by uninjured bystanders, coworkers, or neighbors), as well as by non-medical rescue workers utilizing both standard first-aid kits and improvised materials [4, 7].

The overarching objectives of first aid in natural and man-made emergencies are threefold: (1) to terminate the ongoing exposure of the victim to the damaging factor (e.g., extrication from rubble, removal from a smoke-filled or toxic atmosphere, extinguishing burning clothing); (2) to eliminate immediate threats to life and stabilize vital physiological functions; and (3) to prepare and rapidly evacuate the victim to a specialized medical facility [4, 6, 10].

Among the diverse spectrum of trauma encountered during earthquakes, structural collapses, landslides, and transport collisions, closed mechanical injuries present particular diagnostic and therapeutic challenges [5, 8]. Closed injuries are defined as mechanical damage to subcutaneous tissues, musculoskeletal structures, or internal organs occurring without disruption of the anatomical integrity of the overlying skin or mucous membranes [8, 10]. Because there is no external bleeding to visually signal severity, bystanders frequently underestimate closed trauma, risking catastrophic internal hemorrhage or secondary neurovascular damage during improper movement of the victim [6, 8].

The principal clinical forms of closed mechanical injuries include contusions (bruises), sprains and partial or complete ruptures of ligaments and tendons, joint dislocations, closed bone fractures, and closed blunt trauma to internal organs of the cranial, thoracic, and abdominal cavities [8, 10]. Evidence-based first aid for closed injuries encompasses five essential therapeutic measures:

1. Complete Functional Rest of the Injured Region: Immediate cessation of physical load and creation of a comfortable, anatomically neutral posture for the affected limb or body segment prevent further mechanical tearing of damaged muscle fibers, blood vessels, and nerve trunks [8, 10].

2. Local Cryotherapy (Application of Cold): Applying an ice pack, snow, or cold water compresses wrapped in a cloth over the injured area during the first 20–30 minutes induces local vasoconstriction, which significantly limits interstitial bleeding, reduces post-traumatic edema, and decreases nociceptive pain signaling [4, 8].

3. Compression Bandaging: Applying a moderately tight elastic or gauze bandage to soft-tissue contusions and joint sprains restricts hematoma expansion and provides mechanical support to damaged periarticular tissues, provided distal circulation (pulse, skin warmth, and capillary refill) is continuously monitored [8, 10].

4. Pain Management (Analgesia): Severe pain from closed fractures, dislocations, or extensive contusions accelerates the development of neurogenic and traumatic shock. When permitted by standard first-aid protocols and absence of contraindications (such as acute abdominal pain), appropriate analgesics may be administered alongside physical immobilization to attenuate pain-induced stress responses [6, 8].

5. Transport Immobilization: For severe contusions, tendon and ligament ruptures, joint dislocations, and suspected closed fractures, reliable immobilization using standard transport splints (e.g., Kramer wire splints, pneumatic splints) or improvised rigid materials (boards, sticks, folded cardboard) is mandatory prior to evacuation [8, 10]. Immobilization must fix at least two adjacent joints (above and below the injury

site) without attempting to forcefully realign deformed bones or reduce dislocations on-site [6, 8].

When closed trauma involves the head, chest, or abdomen (manifested by loss of consciousness, unequal pupils, hemoptysis, paradoxical chest wall movement, rigid abdomen, or progressive pallor and tachycardia), internal organ injury and occult hemorrhage must be suspected. Such victims require urgent priority evacuation in a position appropriate to the injury (e.g., semi-sitting for chest trauma, supine with knees slightly flexed for abdominal trauma) without administering food, water, or analgesics that could mask surgical symptoms [6, 10].

First aid in natural and man-made emergencies forms the indispensable foundation for saving human lives and preventing irreversible medical complications [2, 4]. Clinical and epidemiological evidence from major disasters demonstrates that rapid, competent action during the initial minutes following trauma stabilizes the physiological state of casualties, prevents the progression of hemorrhagic and traumatic shock, and substantially increases overall survival rates [5, 6].

Because professional medical services cannot be instantaneously present at every point of a large-scale disaster zone, community resilience depends directly on the preparedness, health literacy, and practical first-aid proficiency of ordinary citizens [3, 7]. Integrating mandatory hands-on first-aid training into secondary schools, higher education institutions—including pedagogical and medical universities—and workplaces equips the population with the confidence and motor skills needed to act decisively under stress [4, 9]. Ultimately, the effectiveness of emergency response at the primary stage relies on the synergy between an informed, well-trained citizenry and a well-coordinated, resilient emergency medical service system.

References

1. Ministry of Emergency Situations & Civil Defense Manual. Classification and Characteristics of Natural and Man-Made Emergencies: Methodological Guidelines. – Baku / Moscow: Civil Protection Press, 2021. – 184 p.

2. World Health Organization (WHO). Health Emergency and Disaster Risk Management Framework. – Geneva: World Health Organization, 2019. – 182 p. ISBN 978-92-4-151618-1.

3. United Nations Office for Disaster Risk Reduction (UNDRR). Sendai Framework for Disaster Risk Reduction 2015–2030. – Geneva: UNDRR, 2015. – 37 p.

4. International Federation of Red Cross and Red Crescent Societies (IFRC). International First Aid, Resuscitation, and Education Guidelines. – Geneva: IFRC, 2020. – 296 p.

5. Levchuk I.P., Tretyakov N.V. Disaster Medicine: Textbook for Medical Universities (Медицина катастроф: учебник). – Moscow: GEOTAR-Media, 2018. – 240 p.
6. American College of Surgeons Committee on Trauma. Advanced Trauma Life Support (ATLS) Student Course Manual. – 10th ed. – Chicago: American College of Surgeons, 2018. – 474 p.
7. Akhundov I.A., Mammadov R.H. Fundamentals of Life Safety and Civil Defense (Həyat fəaliyyətinin təhlükəsizliyi və mülki müdafiənin əsasları). – Baku: Elm və Təhsil, 2020. – 312 p.
8. Bubnov V.G., Bubnova N.V. Fundamentals of Medical Knowledge and First Aid in Emergencies (Основы медицинских знаний и оказание первой помощи в чрезвычайных ситуациях). – Moscow: AST, 2019. – 256 p.
9. Sahni P., Ariyabandu M.M. Disaster Risk Reduction in South Asia and Eurasia: Public Health and Medical Consequences of Disasters. – New Delhi: Prentice-Hall, 2017. – 368 p.
10. European Resuscitation Council (ERC). European Resuscitation Council Guidelines for Resuscitation: First Aid and Pre-Hospital Trauma Care // Resuscitation. – 2021. – Vol. 161. – P. 270–290.