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Global disasters, health needs and the medical response: From historical lessons to evidence-based practice

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Abstract

Modern disaster medicine faces a critical tension between humanitarian impulse and evidence-based necessity. And while disaster risk is the product of Hazard and Vulnerability, socio-economic factors are the primary predictors of crisis outcomes. Therefore, a paradigm shift from reflex-driven (surgical) interventions to resilience-oriented public health strategies should be considered. Through analysis of the 2010 Haiti earthquake, the 2023 Turkey earthquake and the ongoing Gaza conflict, a recurring "Inverted Pyramid of Resources" is identified, where specialised surgical teams are often deployed at the expense of primary healthcare and basic health needs. A professionalisation of aid through the WHO Emergency Medical Team (EMT) initiative, which prioritises standardisation, generalist clinical flexibility and the strengthening of local health systems is a way forward. Ultimately, effective disaster response must be context-specific, with focus shifting toward mitigating significant indirect mortality caused by the collapse of societal support systems.

Take-home message for students Effective disaster relief requires professionalised public health, prioritising basic needs and primary care—over high-tech specialisation. Saving lives requires evidence-based practice, generalist flexibility and the systematic strengthening of local healthcare capacities.

Introduction

Disaster medicine operates within a complex tension between the immediate humanitarian impulse to assist and the necessity for logistical rationality and epidemiological evidence. Historically emerging from the exigencies of military medicine, the discipline today faces multifaceted scenarios ranging from sudden-onset natural hazards to protracted, complex emergencies and conflicts. The frequently observed discrepancy between perceived needs—often perpetuated by public myths and political reflexes—and the empirical reality of health requirements on the ground are presented in the following. Drawing upon historical case studies and contemporary data sets, it argues for a fundamental paradigm shift: moving away from the reflex-driven deployment of surgical specialists and field hospitals towards a resilience-oriented ”Public Health” strategy. This approach must be underpinned by rigorous standardisation, context-specific analysis and the systematic strengthening of local healthcare capacities (Spiegel 2017).

Historical genesis and institutional responsibility

The academic and practical engagement with global health crises is not a phenomenon exclusive to the modern era; rather, it is historically deeply entrenched in the painful experiences of military confrontations and the management of mass casualties. A salient example of this lineage is provided by the history of the Karolinska Institutet in Sweden, an institution whose very inception is inextricably linked to crisis response. Its foundation in 1810 by King Karl XIII was a direct institutional reaction to the humanitarian disaster of the Finnish War against Russia. The mortality statistics of that conflict were harrowing: one in three wounded soldiers succumbed in field hospitals. Crucially, retrospective analysis suggests that these deaths were less attributable to the inevitability of the wounds themselves than to the glaring incompetence of the era's ”barber-surgeons”. This historical watershed moment elucidated a fundamental lesson of emergency relief that remains valid today: benevolent intentions alone are insufficient to save lives. Without founded education, professional structures and evidence-based practice, aid can degenerate into a mere gesture or, in the worst-case scenario, inflict additional harm upon an already vulnerable population. Today, more than two centuries later, this realisation has manifested in specialised institutions such as the ”Centre for Health Crises”.

The role of academic institutions within this framework has undergone a significant transformation. No longer merely citadels of theoretical teaching, they have evolved into active agents of societal resilience. By seconding subject-matter experts to government agencies, conducting ”Operational Research” directly within crisis zones to generate real-time evidence and synthesising political strategy with clinical practice, universities now form the intellectual backbone of modern disaster management. They provide the necessary bridge between the theoretical understanding of crisis dynamics and the practical application of life-saving measures.

The anatomy of a disaster: A theoretical framework

To intervene effectively in crisis situations, precise terminology and a robust theoretical framework are prerequisites. The World Health Organization (WHO) 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 (Disasters WPRO 2026). However, the decisive criterion that categorises an event as a disaster is not the magnitude of destruction per se, but rather the relationship between the impact and the coping capacity. A disaster is deemed to have occurred when the impacts exceed the ability of the affected community or society to cope using its own resources.

This understanding leads to a central equation in disaster risk management, which posits that disaster risk is the product of Hazard and Vulnerability (United Nations Office for Disaster Risk Reduction 2023):

Risk = Hazard × Vulnerability

In this equation, a ”Hazard” — whether it be a seismic event, a tsunami, or a viral pathogen — does not inevitably lead to a disaster. It is only the intersection of this hazard with a vulnerable societal structure that precipitates the disastrous event. Consequently, the magnitude of a disaster is often less a function of the natural force itself and more a reflection of the pre-existing fragility of the affected system.

Socio-economic determinants of vulnerability

Vulnerability is the most variable and, crucially, the most modifiable variable in this equation. It is determined by a complex interplay of factors including demographics, the pre-existing burden of disease, the quality of governance and, pre-eminently, socio-economic status. A comparative analysis of global economic data reveals a dramatic disparity in health resilience. While high-income nations such as the United States or Sweden expend thousands of US dollars per capita on healthcare annually (approximately $12,500 and $6,100 respectively), low-income countries are often restricted to expenditure in the low hundreds, averaging around $310.

This factor — which can differ by a magnitude of forty — is the true predictor of a crisis outcome. An identical physical event, such as an earthquake of magnitude 7.0, encounters diametrically opposed levels of resilience depending on the geography of its occurrence. In a high-resource setting, it may result in significant property damage but limited loss of life; in a low-resource setting, the same energy release can cause societal collapse. In this context, it becomes evident that effective disaster preparedness cannot solely rely on emergency response mechanisms but must primarily entail the reduction of structural inequality and the strengthening of local health systems prior to the event.

Phenomenology of hazards: Natural events versus anthropogenic conflicts

In public perception and media representation, various types of disasters are frequently viewed through a monolithic lens, leading to uniform and often erroneous aid strategies. It is scientifically essential to differentiate rigorously between natural hazards and man-made conflicts, as

these scenarios demand vastly different medical intervention profiles and logistical responses.

The reality of natural disasters

In the case of natural disasters, such as earthquakes, the acute phase is indeed characterised by a high incidence of traumatic injuries (crush syndrome, fractures) and immediate damage to infrastructure. However, the epidemiological profile evolves rapidly. In contrast, floods rarely result in mass trauma but precipitate long-term supply shortages, contamination of water sources and displacement.
A persistent myth in this context, often perpetuated by the media and resulting in unnecessary anxiety, is the fear of epidemics caused by unburied bodies. Scientific evidence has repeatedly demonstrated that the bodies of victims killed by natural disasters do not pose an acute epidemic risk (”cadaveric risk”). The deceased do not serve as a reservoir for epidemics unless they died of infectious diseases like cholera or haemorrhagic fevers, which is rarely the case in geological disasters. The true danger for outbreaks of communicable diseases arises secondarily: through the destruction of water and sanitation (WASH) infrastructure and the overcrowding of survivors in temporary shelters, which facilitates the transmission of respiratory and diarrhoeal pathogens.

The destructive force of conflicts

Conversely, armed conflicts present a completely distinct pathology. While kinetic violence, aerial bombardment and landmines cause significant direct traumatic injuries and complex polytrauma, the indirect mortality associated with conflicts is far more severe. Empirical studies indicate that in protracted crisis zones, indirect mortality — deaths not caused by weapons but by the collapse of societal support systems — is three to fifteen times higher than direct casualty numbers (Degomme and Guha-Sapir 2010).
The drivers of this excess mortality include mass displacement, the breakdown of pharmaceutical supply chains, the flight or targeted killing of medical personnel and the deliberate or collateral destruction of healthcare facilities, lack of access to basic commodities such as water and sanitation, shelter, food and protection. Conflicts thus generate a chronic, deteriorating public health crisis that is statistically more lethal than the battlefield injuries. The loss of management for chronic conditions, the cessation of vaccination programmes and malnutrition contribute to a ”silent” death toll that dwarfs the violence.

The reflex and the misunderstanding: Individual medicine versus Public Health

When a disaster strikes, a global reflex is almost instantaneously triggered: the cry for immediate assistance (”Send relief!”), which typically manifests in the mobilisation of field hospitals, surgical teams and ad hoc donations of pharmaceuticals. This impulse, whilst understandable from a humanitarian and empathetic perspective, is frequently based on a profound misjudgement of the actual needs on the ground.
There exists a fundamental conflict between the logic of clinical, individual

medicine and the necessities of Public Health in a crisis setting. Individual medicine focuses on the specific patient, utilising highly specialised interventions, diagnostics and therapies dosed in milligrams and millilitres. This approach is resource-intensive, logistically demanding and, by definition, limited in its reach. In a disaster scenario where systems are collapsing, the focus must shift to the population level. In this context, the metrics of success are tonnes of relief goods and cubic metres of potable water. This perspective is however seldom taught to us in medical school. We remain seeing one patient at a time while having access to enough resources without having to triage between patients

The inverted Pyramids of Needs and resources

This dilemma can be conceptualised as the collision of two incongruent pyramids.
The Pyramid of Needs possesses a broad base. In the immediate aftermath of a disaster, the vast majority of the affected population requires basic survival necessities: potable water, sanitation, shelter and food security. Above this lies the need for the management of the ”normal” burden of disease (non-communicable diseases, routine infections, maternal health). Only the narrow apex of this pyramid consists of patients requiring complex, specialised surgical intervention for severe trauma.
However, the international community frequently responds with an Inverted Pyramid of Resources (Schreeb et al. 2008). Disproportionate amounts of funding and logistical capacity are directed towards deploying highly specialised teams (neurosurgeons, orthopaedic trauma specialists, intensive care units) that target the narrow apex of needs. Meanwhile, the broad base of essential care is often neglected. The result is an inefficient allocation of resources: highly advanced Western medicine is airlifted into an environment that lacks the most fundamental prerequisites for survival, such as electricity, clean water and security. This mismatch not only wastes resources but can also clog local logistics channels, preventing essential goods from reaching those in need. This logic will remain even when high income countries are affected. Public health and primary health care should always be the backbone for response to any type of disaster that shocks the health system.

Professionalisation of aid: The Emergency Medical Teams (EMT) initiative

The earthquake in Haiti in 2010 marked a watershed moment in the history of humanitarian aid. The uncoordinated arrival of thousands of Non-Governmental Organisations (NGOs) and medical teams, many of whom were neither self-sufficient nor adequately qualified, led to chaotic conditions. Some teams arrived without food or water, becoming a burden on the local population; others performed surgeries outside established protocols, leading to poor outcomes. There was no accountability for the assistance provided. The affected had to rely on those good intentions was sufficient, but it was not. This experience of the ”shame” of unprofessional aid catalysed a rethinking process within the World Health Organisation (WHO) and led to the establishment of the Emergency Medical Teams (EMT) Initiative.
The objective of this initiative is the establishment of a global standard — comparable to an international emergency services

system ("Global 112"). Instead of relying on mere goodwill and volunteerism, the system demands accredited quality and interoperability. Through a rigorous classification process, teams are categorised into defined types (Norton et al. 2013):

- **Type 1:** Outpatient Emergency Care. These teams provide initial triage, assessment and first aid. They are mobile and designed to stabilise the broad mass of the population, treating minor injuries and infections.
- **Type 2:** Inpatient Surgical and Emergency Care. These facilities can perform surgery, general obstetric surgery and inpatient care.
- **Type 3:** Inpatient Referral Care. These are advanced field hospitals with critical care capabilities,

Specialised Care Teams: These provide niche capabilities such as rehabilitation, dialysis, or burn care.

This classification creates transparency and predictability. An affected nation can specifically request the type of aid it requires, secure in the knowledge that an arriving EMT will be self-sufficient (bringing its own power, water and waste management) and will not burden the local system. Several German EMTs have been classified, and these efforts are supported by the Robert Koch Institute (RKI) as the National Focal Point. A majority of the German EMTs are Type 1 teams and include NGOs (e.g., ASB, Johanniter, Malteser, Humedica), acknowledging that mobile outpatient care is often more critical than static surgical facilities.

Empirical evidence from the field: Lessons from Turkey and Gaza

The theoretical necessity of this strategic shift is underpinned by robust empirical data from recent major catastrophes.

The Turkey earthquake (2023)

An analysis of medical data following the devastating earthquake in Turkey (utilising the WHO Minimum Data Set) revealed that the demand for complex trauma field hospitals is often overestimated. The data from more than 50,000 consultations by the 38 EMTs that was deployed indicate that only approximately 10% of patient consultations were directly related to earthquake-induced trauma. The overwhelming majority of cases (63%) involved health issues with no direct causal link to the seismic event itself. These included acute respiratory infections, skin conditions (such as scabies outbreaks in crowded shelters), diarrhoeal diseases and the management of chronic conditions like hypertension and diabetes.

This evidence vividly underscores that even following massive kinetic events like earthquakes, the window for life-saving trauma surgery closes rapidly (often within 24-48 hours). Thereafter, the restoration of basic primary health care becomes the paramount medical priority. In the case of Turkey, more than 50,000 injured were within the first day of the earthquake referred by cars, ambulances, helicopters and air to hundreds of hospitals around Turkey. In a functional middle-income country that has been affected by a sudden onset disaster, and else remain partly functional, the rapid evacuation of trauma patients is an effective strategy.

The conflict in Gaza (2023–2025)

In contrast, the situation in the Gaza Strip presents a highly complex epidemiological profile. Here, the total destruction of infrastructure combined with continuous hostilities resulted in exceedingly high casualty numbers. Whilst the surgical requirement was indeed immense—with over 50,000 emergency surgical procedures recorded—data from coordinated EMT operations coordinated by the EMT Coordination Cell (EMTCC) revealed the dominance of public health crises even in this context.
Hundreds of thousands of consultations were required for non-communicable diseases, malnutrition and maternal health issues. The collapse of the local health system meant that EMTs had to provide the safety net for the entire population, not just the war-wounded. Over 3.5 million general consultations were conducted, dwarfing the surgical figures. The challenge in such contexts transcends medical care; it involves navigating severe access constraints, security risks and the politisation of aid. Nevertheless, the concept of coordination and the ”localisation” of aid—supporting remaining local structures rather than replacing them—proved essential.

Conclusion: Context and adaptability

In synthesis, the research and experience of the Centre for Health Crises shows that modern disaster medicine must move away from rigid, pre-conceived reflexes. We must generate new knowledge that goes beyond pre-conceived opinions. This will require field-based research and presence in disasters also for those conducting research. The overarching maxim is that ”Context is everything.” There is no universal panacea; every scenario demands a specific, granular analysis of the hazards involved and the inherent vulnerabilities of the affected society.
A central realisation for medical personnel in disaster relief is the necessity for cognitive and clinical flexibility. The highly specialised consultant must be willing and able to function as a generalist. In many scenarios, the restoration of water and sanitation systems represents a more effective medical intervention than the scalpel. Horizontal prioritisation—interventions that target the broad health of the population across the board—must take precedence over vertical, disease-specific, or purely surgical programmes.
To achieve this, professional preparation is non-negotiable. We must learn to make ethically challenging decisions under conditions of extreme resource scarcity, clarify mandates and decentralise decision-making processes. Only through continuous training, strict adherence to evidence-based protocols and a shift away from ”disaster tourism” towards integrated, accredited teams can the chasm between the desire to help and the effectiveness of the aid be bridged.

Core demands for future-proof disaster medicine

Based on the analysis of historical developments, theoretical risk models and empirical operational experiences, the following five core demands are postulated for the policy and practice of international humanitarian aid:

1. Prioritisation of Public Health over specialisation

The deployment of personnel and materiel must strictly align with the empirical hierarchy of needs. The restoration of basic services—Water, Sanitation and Hygiene (WASH), the management of chronic diseases and infection prevention and control—must take precedence over the provision of highly specialised, niche surgical capacities, unless a specific, verified request for the latter exists. The medical response must address the base of the pyramid, not just the apex (Schreeb et al. 2008).

2. Accreditation and standardisation

To prevent the recurrence of chaotic, uncoordinated aid scenarios (such as the "Haiti 2010 scenario"), the international community should enforce a strict regime where only teams that are classified, trained and authenticated. Good intentions are not enough! One mechanism for professional accountability is the WHO Emergency Medical Team (EMT) initiative, a community of practitioners that has agreed on a number of technical standards for quality assurance and a coordination mechanism supporting the ministry of health in disaster affected countries. This EMT system has global buy in and may prevent ad hoc initiatives and non-experienced teams to deploy. However, it must be acknowledged that coordination carries a risk in that neutral, independent and impartial humanitarian assistance becomes institutionalized and politicised, risking that it will serve other goals than those of the population in need (Norton et al. 2013).

3. Investment in local resilience and generalist skills

Training curricula and preparedness planning must shift focus from producing superspecialists to cultivating versatile generalists capable of treating a broad spectrum of conditions under adverse environments. Concurrently, international aid strategies must include the strengthening of local health systems (vulnerability reduction) as a primary objective, recognising that local communities are invariably the first responders and the backbone of long-term recovery.

4. Context-driven rather than reflex-driven intervention

Every humanitarian intervention must be predicated upon a rapid, yet robust, evidence-based analysis of the specific context (e.g., differentiating between the needs of a natural disaster versus a complex conflict; assessing the pre-existing economic status and burden of disease). The political and media-driven reflex to "send doctors immediately" must be replaced by needs-based assessments to prevent resource wastage and maldistribution.

5. Recognition and mitigation of indirect conflict consequences

In zones of conflict and protracted crisis, the humanitarian response must fundamentally re-evaluate its focus to aggressively mitigate indirect health effects. The protection of healthcare infrastructure, the maintenance of vaccination campaigns and the securing of supply chains for chronic disease management must be accorded the same priority as acute trauma care, acknowledging that indirect mortality in these settings historically exceeds direct casualty figures by a significant margin.

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