Management of the Care of the Injured and Sick in Emergencies

Katarina Štrbac[1]
Brankica Pažun[2]

Abstract: *Managing the care of the injured and sick in emergencies is critical to disaster and emergency preparedness. Effective management is essential to saving lives and minimizing suffering, whether it's a natural disaster, a public health crisis, a mass casualty event, armed conflicts, or any other emergency. For every possible emergency, it is necessary to follow fundamental principles and steps: preparedness, assessment and triage, resource allocation, communication, evacuation and transportation, and coordination with other institutions. Effective management of the injured and sick care in emergencies requires careful planning, coordination, and adapting to rapidly changing situations. Collaboration among healthcare organizations, government agencies, and the community is crucial to ensure the best possible outcomes for those affected by emergencies. Coordinated activities in a society are vital to be prepared for emergencies, including developing emergency response plans on all levels. Management plays a crucial role in strengthening the resilience of communities and effective response to emergencies. The involvement of civil society, cooperation with the government and local self-governments, partnership with the private sector, identification of challenges and obstacles, and recommendations for improving the management system are critical factors for successful risk management. Due to the necessary time caring for sick and injured people, one possible solution could be modern information technology. This paper is trying to raise the importance of this issue.*

1. INTRODUCTION

There has been a noticeable rise in the frequency of major emergencies, crises, and disasters. This pattern is not confined to any particular geographical area but mainly affects middle and low-income countries. These events significantly impact people's lives, disrupt essential services such as healthcare, and hinder sustainable human development. Such incidents can lead to fatalities, injuries, displacement, and infrastructure damage. "Most vivid in the public imagination are natural disasters – events of a scale that endanger both populations and environments, such as floods, windstorms, and earthquakes. According to historical data, the number of recorded natural disasters since 1900 has increased, as has the number of people affected. At the same time, man-made events are growing in frequency and impact. In the 1970s, man-made events accounted for 16.5% of disasters and 4.3% of related deaths; in the 1990s, they had risen to 42% and 9.5%, respectively (these figures do not include "complex emergencies" involving armed conflict and a total breakdown of authority)'' (World Health Organization, 2007).

The biggest problem arises when an emergency suddenly occurs, including armed conflicts, when there is no immediate response nor adequate care for the injured and sick. The reasons for this are multiple. One of the main reasons lies in the sudden events and the fact that very few countries can

[1] Faculty of Engineering Management, Bulevar Vojvode Mišića 43, 11000 Belgrade, Serbia
[2] Faculty of Engineering Management, Bulevar Vojvode Mišića 43, 11000 Belgrade, Serbia

OPEN ACCESS

care for all the injured and sick in urgent need. In addition to sudden natural and technological accidents, we have witnessed a large number of wounded and sick people in recent armed conflicts, as well as inadequate management of care for the sick at the beginning of the COVID-19 pandemic.

Being prepared for such incidents is crucial. Governments, local communities, and health organizations must have organized and scalable response systems to minimize the damage and save lives. Health authorities, particularly at the national level, play a crucial role in both preparing for and responding to emergencies. Their involvement is essential for effective preparedness and response efforts. Proper preparedness can help prevent or mitigate these issues. This interdisciplinary approach ensures a more comprehensive and effective response. Addressing emergency requests requires increased coordination efforts and investment in preparedness planning and infrastructure. "In particular, many countries have not yet developed Mass Casualty Management Plans, and communities are too often left alone to develop preparedness and response plans without higher-level guidance" (World Health Organization, 2007). In his brief to the Committee, High Commissioner for Refugees Filippo Grandi, in his report 2023, said the number of forcibly displaced worldwide has soared to a record 114 million people, a jump of 4 million since May (UN News, 2023).

Persons who have been forcibly displaced and who otherwise come from areas where health care is poor do not have adequate access to health services. "According to the Centre for Research on the Epidemiology of Disasters, a disaster is defined as a situation or event that surpasses local capacity, requiring a request for external assistance at the national or international level. It is an occurrence that is typically unforeseen and abrupt, resulting in extensive damage, destruction, and human suffering" (Harms & Alston, 2018).

The World Health Organization describes mass casualty incidents as disasters and major incidents distinguished by the quantity, severity, and diversity of patients, which can quickly surpass the capacity of local medical resources to provide comprehensive and definitive medical care. Occurrences of these events have become more frequent in recent decades, impacting countries across various socioeconomic backgrounds. Preparedness and planning are crucial, as these events can occur in any community at any given time. "Defined pre-hospital triage systems are essential in saving lives and optimizing the initiation of resource allocation when these disasters strike" (Clarkson & Williams, 2023).

Given the possibility of sudden emergencies caused by natural phenomena or, for example, terrorist attacks or armed conflict in which mass injuries can occur quickly, states should also define the rules of action and behaviour in such cases. For the care of the vulnerable civilian population to be adequate, it is necessary to engage healthcare systems in caring for the population. The competent state authorities should regulate the possibility of free distribution of medicines to injured and sick persons or with minimum participation. Given the complexity of the disaster management process, various actors are involved in multiple phases and different capacities. "In general, the actors that are involved in disaster management can fall into any of the following groups or types: government, multilateral organizations (including financial institutions), private sector and civil society, including long-term and short-term NGOs, academia and media" (Macapayag & Misic, 2015).

Managing the process of caring for the injured is a complex process, especially in demanding circumstances. Although countries have systems for the operation of medical teams in such circumstances, the fact is that it is not always possible to provide an emergency response. Therefore, most victims are in the triage process until they arrive at an adequate medical facility. In

those moments, there is a need to act to assess the condition of the injured and sick adequately. The cooperation of all relevant actors, especially the establishment of mobile medical teams, is essential in preparing for and responding to emergencies.

With the advent of modern information technology, we can streamline and assist the existing emergency management processes. Emergencies provide a difficult environment for keeping track of injured people and their needs with regular means. Applying information technology in digitalized databases and distributed communication devices allows more manageable and more durable tracking of injured and sick people in emergencies.

The ability of emergency response teams to communicate with each other during an emergency is crucial for the care of the injured and sick, especially for mobile medical teams. On-field information technology systems such as edge computing devices and remote telemetry solutions allow the field teams to perform rapid triage and constant automated monitoring of injured and sick, allowing the field teams to focus on more critical patients. Another benefit is the remote distribution of information between emergency teams using distributed database technologies like blockchain. This allows them to share resources via information technology protocols like HTTPS.

2. OBJECTIVES

"Considering that there are dilemmas regarding the triage of patients according to the duration of the first examination and that, according to research, it is considered that the intuitive way is faster than the algorithmic one, it would be useful to investigate a method of a simple algorithm that would not prolong the arrival time of the injured and sick in an adequate medical institution" (Hart et al., 2018). The research objective of this paper is to relate the international efforts and strategies for finding solutions for a quick and adequate measure of caring for the injured and sick in emergencies. Also, provide recommendations on procedures for short management of emergencies in part related to treatment. The use of technology in such cases can be of great help. Indeed, further research in this area is necessary to reduce the time of caring for people in emergencies.

The objectives can be summarised in the below:
- To determine the effects of caring for the injured and sick in emergencies,
- Analysis of the current international policies on management in emergencies and part related to the care of endangered,
- Determine the effective use of technology in such cases.

3. PREVIOUS RESEARCH

According to the available literature, several emergency care methods exist for the population in emergencies. However, most authors emphasize that it has been observed that mortality is high by the time of arrival at the hospital. Practically, it would be necessary to reduce the time from the moment of the emergency to the admission of the injured and sick to a health facility. Therefore, it is necessary to establish adequate management at the level of the state, local community, and medical teams. Regardless of the proper engagement of medical teams, it is necessary to increase efficiency and establish the organisation of the teams' work for the urgent treatment of the injured and sick.

"Mortality increased with the increasing scale of MCIs, medical rescue capability of hospitals was relatively good, but the efficiency of organisation and command was poor, and the pre-hospital

time was too long. Mortality declined when increasing ambulances and improved the efficiency of organisation and command; triage and on-site first-aid time were shortened if the availability of emergency medical staff. The effect was the most evident when 2,000 people were involved in MCIs; however, the influence was very small under the scale of 5,000 people" (Yu et al., 2018). The problems of managing emergencies in part related to the injured and sick were the most visible compendium of the COVID-19 epidemic. Recognizing the importance of adequate care for the injured and sick in accidents with many victims, the World Health Organization (WHO) published "Mass Casualty Management Systems: strategies and guidelines for building health sector capacity" in 2007 to point out the need for better preparation and the need to develop care plans.
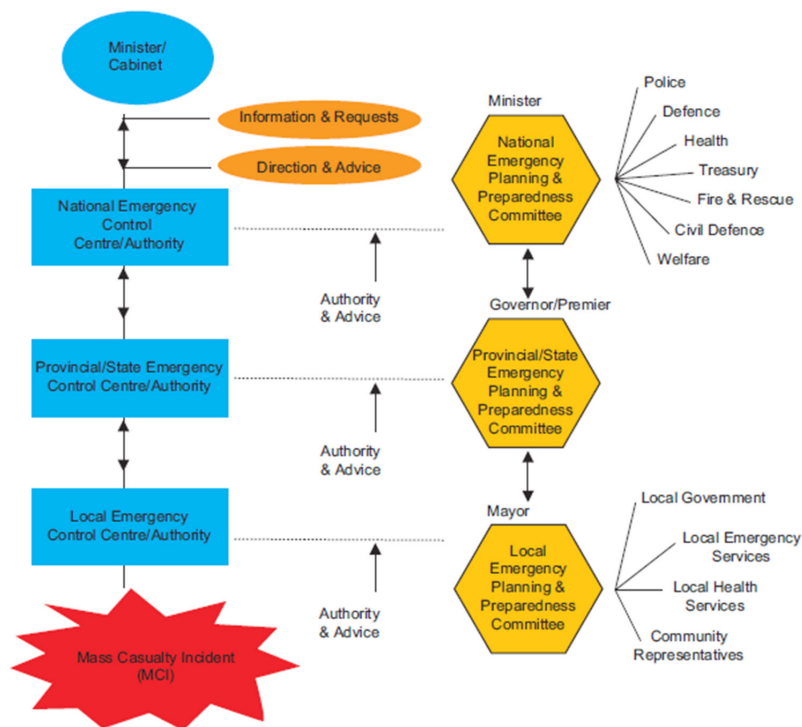

Figure 1. National Emergency Operational and Preparedness Structure
Source: World Health Organization, 2007

Even though the WHO wrote strategies and guidelines from the previously mentioned sources, it can be stated that the situation has not improved much until today. Many authors emphasize the importance of an adequate medical care system in emergencies.

"A comprehensive approach to strengthening health systems and care is therefore shown to be indispensable for disaster preparedness and response" (BündnisEntwicklungHilft, 2023). "Since the publication of the first mass casualty triage protocol approximately 30 years ago, numerous adaptations and alternatives have been introduced and are currently in use worldwide. This variety may represent a challenge for the cooperation between emergency medical providers and the interoperability of emergency medical services often required during mass casualty incidents. To enhance cooperation and interoperability, a standardization of triage protocols is required" (Streckbein et al., 2016). Adequate management was not established even during the COVID-19 pandemic, which would call for change in management during emergencies.

Regarding local communities, in many cases, there is no interest in establishing better management for emergencies. As Cvetković et al. (2021) stated "In the realm of establishing expert

operational teams and standing commissions for damage assessment, there has been little to no significant advancement. Particularly in domains demanding substantial political, professional, and public dedication, along with significant resource allocations, such as the establishment, training, and equipping of general-purpose civil protection units, situation centers, acoustic studies, the development of an alert system, personal and collective protection, and simulation exercises, the overall status is generally unsatisfactory. There is notable inadequacy in the operational and tactical competencies of local self-government in these areas".

It would be expected that the states were prepared for such an emergency. "Thousands of healthcare workers have been infected amid the ongoing coronavirus outbreak, a sign of the challenging working conditions for doctors, nurses, and healthcare workers. They should be instead among those best protected. The infections, along with the deaths of several doctors in China, underscore the deeply challenging, chaotic environment that healthcare workers face when toiling on the front lines of an epidemic outbreak. They face long hours, changing protocols, potential medical supply shortages, and risks to their health and loved ones. In every mass casualty event, the healthcare workers who go to the forefront are the main actors. The lack of national and international action plans forced health workers to work in a situation of extreme unsafety" (Coccolini et al., 2020).

During the Java earthquake in 2006, Japan provided medical help, but due to poor management, it faced problems that could have been solved if the Government of Indonesia had an appropriate management system. "The JDR Medical Team opened a temporary clinic on the street in front of Muhammadiyah Hospital, one of the largest hospitals in the city of Bantul, to support its medical operations. Initially, the JDR Medical Team started diagnosing patients who could not be treated at the hospital due to overcapacity. However, the team and the hospital soon started working complementarily by, for example, requesting that the hospital receive patients for whom the team could not provide adequate treatment due to lack of equipment. Because the hospital was well prepared for the potential eruption of Mt. Merapi, it was able to recover its medical service by the time the JDR MedicalTeam completed its activities and smoothly took over the activities of the JDR team" (Japan International Cooperation Agency, 2008).

"Lack of a predefined disaster management plan including need to prevent infected people from entering emergency departments and to place the triage systems outside the emergency departments from the beginning of the infection outbreak" (Coccolini et al., 2020).

"Abandoning the reactive way of preparing for disasters and increasingly implementing proactive measures, societies are desperately trying to improve their resilience in resource-scarce situations and mitigate future consequences of disasters" (Cvetković & Šišović, 2023).

"It is necessary to establish joint emergency response mechanisms. However, meeting this precondition requires political will, predominantly, both in the region and Europe" (Strbac, 2009).

"Whether it be drought, cyclone, earthquake, or floods when an extreme natural event hits a village or a town, the vulnerability of the society crucially depends on the population's health status as well as the health care, and it is functioning in crisis and disaster situations. But in times of the global financial crisis, the health systems worldwide are subjected even more strongly to economic principles. Often, humans facing an unacceptable vulnerability suffer the most from these austerity and privatisation measures" (World Risk Report, 2023).

4. FUTURE RESEARCH DIRECTION

Effective management of the injured and sick care in emergencies requires careful planning, coordination, and adapting to rapidly changing situations. Collaboration among healthcare organisations, government agencies, and the community is crucial to ensure the best possible outcomes for those affected by emergencies.

As mentioned before, applying information technology can increase efficiency in managing injured and sick people in emergencies. The design of specialised software that can quickly be deployed in emergencies for communication and tracking is one of the more promising approaches. This would allow easier tracking of injured and sick people and increase information sharing during emergencies. Information technology infrastructure processes are also an important research area since this would enable a standardised approach to deploying information technology to manage injured and sick.

Due to the number of different protocols and implementations of information technology solutions, a review of the common communication protocols such as HTTP or MQTT applied to emergencies for different scenarios would give future improvement to the organisation of information technology in aid to the injured and sick.

5. CONCLUSION

We have identified the following principles as crucial points for managing injured and sick people in emergencies: preparedness, triage, resource allocation, communication, patient care, coordination with other agencies, reporting, and review.

Developing emergency response plans is essential and training for preparedness. Clear protocols and rapid assessments should cover the triage process, while resource allocation should depend on the strategic situation of emergencies.

If possible, communication methods should be predefined and established before emergencies appear. To keep them operative, it is necessary to implement information technology solutions such as software and digitalised databases to maintain stability.

Similar to communication, patient care principles should be defined beforehand, and emergency resources should be available to emergency personnel to maintain the status of injured and sick.

Multiple agencies are often involved in the processes surrounding an emergency involving the sick and injured. Orchestration between different agencies and collaboration is of prime importance in sharing necessary resources and information regarding emergencies.

After the emergency passes, documentation and reports must be generated to gauge the effectiveness of measures taken during the emergency and the current status of the sick and injured. This becomes trivial when necessary information technology solutions have been deployed before and used during emergencies. An additional advantage is the capability to execute or perform more accessible reviews, improve processes and protocols, and potentially simulate new emergencies based on existing ones.

References

BündnisEntwicklungHilft. (2023). https://entwicklung-hilft.de/

Clarkson, L., & Williams, M. (2023). EMS Mass Casualty Triage. [Updated 2023 Aug 8]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK459369 /

Coccolini, F., Sartelli, M., Kluger, Y., Pikoulis, E., Karamagioli, E., Moore, E. E., Biffl, W. L., Peitzman, A., Hecker, A., Chirica, M., Damaskos, D., Ordonez, C., Vega, F., Fraga, G. P., Chiarugi, M., Di Saverio, S., Kirkpatrick, A. W., Abu-Zidan, F., Mefire, A. C., … Catena, F. (2020). COVID-19 the showdown for mass casualty preparedness and management: the Cassandra Syndrome. *World Journal of Emergency Surgery, 15*(1). https://doi.org/10.1186/s13017-020-00304-5

Cvetković, M. V., & Šišović, V. (2023). Capacity Building in Serbia for Disaster and Climate Risk Education. SSRN. http://dx.doi.org/10.2139/ssrn.4575350

Cvetković, M. V., Tanasić, J., Ocal, A., Kešetović, Ž., Nikolić, N., & Dragašević, A. (2021). Capacity Development of Local Self-Governments for Disaster Risk Management. Int. *J. Environ. Res. Public Health, 18*, 10406. https://doi.org/10.3390/ijerph181910406

Harms, L., & Alston, M. (2018). Postdisaster Social Work. *Australian Social Work, 71*(4). https://doi.org/10.1080/0312407x.2018.1495241

Hart, A., Nammour, E., Mangolds, V., & Broach, J. (2018). Intuitive versus Algorithmic Triage. *Prehosp Disaster Med, 33*(4), 355-361. https://doi.org/10.1017/S1049023X18000626

Japan International Cooperation Agency. (2008). Building Disaster Resilient Societies. Tokyo, Japan: JICA. Retrieved from http://www.jica.go.jp/english/our_work/thematic_issues/water/pdf/cooperation_01.pdf

Macapayag, N., & Misic, G. (2015). Trends and Patterns in Natural Disaster Management in Europe and Central Asia 1993-2014. School of Public Policy, Central European University, Policy Lab research Report 2015/3. Retrieved from https://cps.ceu.edu/sites/cps.ceu.edu/files/attachment/basicpage/143/ceu-policy-lab-ifrc-natural-disaster-mgmt-europe-and-central-asia-2015.pdf

Strbac, K. (2009). Emergencies: How to manage them?. Belgrade, Serbia: OSCE Mission to Serbia.

Streckbein, S., Kohlmann, T., Luxen, J., Birkholz, T., & Prückner, S. (2016). Sichtungskonzepte bei Massenanfällen von Verletzten und Erkrankten: Ein Überblick 30 Jahre nach START. *Der Unfallchirurg, 119*(8), 620–631. https://doi.org/10.1007/s00113-014-2717-x

UN News. (2023). UN humanitarian chief warns of escalating conflict in Ethiopia, with 4 million displaced since May. Retrieved from https://press.un.org/en/2023/gashc4395.doc.htm#:~:text=In%20his%20brief%20to%20[th]e,of%204%20million%20since%20May.

World Health Organization. (2007). Mass casualty management systems, Strategies and guidelines for building health sector capacity. Health Action in Crises, Injuries and Violence Prevention, WHO.

World Risk Report. (2023). Berlin, Germany: Bündnis Entwicklung Hilft. Retrieved from https://weltrisikobericht.de/en/

Yu, W., Lv, Y., Hu, C., Liu, X., Chen, H., Xue, C., & Zhang, L. (2018). Research of an emergency medical system for mass casualty incidents in Shanghai, China: a system dynamics model. Patient Prefer Adherence, 12, 207-222. https://doi.org/10.2147/PPA.S155603