The Role of Emergency Medicine Providers in Disaster Preparedness and Response

Abdul Rahman Abdullah Al-Fawzan[1]*, Mohammed Saad Albidah[1], Ibrahim Saad Al-Bidah[1], Bati Badr Al-Otaibi[1], Meshal Jalawi Almutairi[1], Mesfer Sultan Alaklobi[1], Saad Hazzaa Gazi Aljsh[1], Salman Abdullah Alghamdi[1], Abdulwahab Mohammed Alalyani[1], Muhammad Eid Al-Qahtani[1], Mahdi Suhaim Al-Shaibani[1], Basheer Dhaher Alanazi[1], Naif Fahad Alharbi[1], Lafi Ali S Almutairi[1], Belal Mohammed Alotaibi[1]

[1]*KSA, Ministry of Health

***Corresponding Author:** Abdul Rahman Abdullah Al-Fawzan
*KSA, Ministry of Health

Abstract
In emergency and calamity situations, the emergency medical service (EMS) administers primary medical attention to individuals in need of immediate medical attention. Preparedness is the optimal strategy for effectively managing catastrophe risks, and it is crucial for emergency medical service (EMS) providers, including paramedics, emergency medical technicians (EMT), and other EMS workers. This systematic review aims to examine the data about the level of readiness of emergency medical care providers in emergency and catastrophe scenarios by a comprehensive analysis of peer-reviewed journal articles. This project will analyze peer-reviewed publications published from 2005 to 2019 to investigate the level of readiness shown by emergency medical care providers in response to crises and catastrophes. A comprehensive search will be conducted on Scopus, Web of Science, PubMed, and Google Scholar to discover published papers on emergency and catastrophe preparation. As far as we know, there has not been a thorough evaluation research on the level of readiness of emergency medical care providers in catastrophe scenarios. This paper is the first effort to fill this need. The study will also examine the crucial aspects of disaster preparation among emergency medical service providers and the methods to improve their readiness. The first stage in creating effective tools to assess the disaster readiness of EMS providers and enhancing their level of preparedness involves identifying the crucial aspects of preparedness for emergencies.

Keywords: Medical Technician, Preparedness, Disaster Competencies, Emergency Medical Technician.

1. Introduction

The emergency medical service (EMS) delivers immediate and critical medical assistance to those requiring urgent and essential medical attention in emergency and catastrophe scenarios. According to the World Health Organization (WHO), EMS is seen as a crucial component of a well-functioning and productive healthcare system [1]. Catastrophes, particularly natural catastrophes, are unavoidable and happen in practically every part of the globe, impacting populations [2]. In 2018, there were 281 climate-related and geophysical occurrences worldwide [3]. As of the publication of this study on August 22, 2020, the Covid-19 pandemic had resulted in the death of 848,484 individuals globally [4]. A catastrophe may be defined as any incident that surpasses the capacity of current social structures [1].

According to the United Nations Office for Disaster Risk Reduction (UNISDR), a disaster is a significant disturbance in the operation of a community or society caused by dangerous events that interact with conditions of vulnerability and exposure. This results in extensive losses and impacts on humans, materials, economy, and the environment [5]. Managing the repercussions of crises and disasters, especially their health implications, is crucial due to their widespread occurrence. This approach has been supported by international organizations such the Sendai Framework for Disaster Risk Reduction (SFDRR) 2015–2030 [6]. readiness is a crucial aspect of managing and reducing the risks associated with disasters. The SFDRR 2015-2030 highlights the need of enhancing readiness as one of the top goals in the plan for reducing disaster risks. Preparedness is both an end result and an objective of disaster risk reduction (DRR). Health systems are crucial cornerstones of communities and play a vital role in reducing catastrophe risks. Therefore, it is crucial to provide careful attention to the readiness of the healthcare systems, particularly emergency medical services (EMS) systems, in order to guarantee the successful execution of the Sendai Framework for Disaster Risk Reduction (SFDRR) from 2015 to 2030 [8].

EMS systems globally provide primary medical assistance to those affected by emergencies and disasters [1]. The historical involvement of civilians, particularly in providing care for the fatalities of previous conflicts, has greatly influenced the development of contemporary ideas and procedures in emergency medical services (EMS) [1]. The US Civil War served as a significant catalyst for the establishment of EMS systems in the United States [9]. Emergency medical care systems have seen significant development worldwide during the last 50 years and continue to evolve today [1]. The global proliferation of significant catastrophes and disasters has heightened the need for prehospital emergency

care services. Consequently, it has been determined that EMS professionals must undergo enhanced training and preparation to provide a well-coordinated and effective response [1].

Emergency Medical Services (EMS) providers are the initial healthcare responders in both natural disaster areas and manmade disaster areas, including chemical, biological, radiological, and nuclear sites, as well as locations involving explosive-related agents (CBRNE), which are susceptible to terrorist attacks [10]. Emergency Medical Services (EMS) have a crucial role in the preparation, response, and recuperation from emergencies and disasters. According to the United States Department of Homeland Security (USDHS), EMS is responsible for incident management, triage, prehospital treatment, managing and distributing medical equipment, preventing and caring for injuries, and ensuring the safety of affected individuals in different emergency and disaster scenarios [11].

An examination of the present condition of disaster preparation and the proficiency of EMS providers in addressing emergencies and disasters might be a significant stride in improving the outcome and recovery from such events. The lack of readiness among EMS providers might result in unfavorable consequences and hinder the efficient recovery from catastrophes within communities [12]. Hence, this systematic research aims to investigate the levels and essential aspects of emergency medical care providers' readiness in addressing significant crises and disasters. The objective is to get a better understanding of their preparation in managing catastrophic events.

2. Methods

2.1. Search Strategy

The relevant studies will be accessed by searching electronic databases such as PubMed, Web of Science Core Collection, Scopus, and Google Scholar. To search each database, the keywords are first identified, then their synonyms are supplied using MESH. Subsequently, the aforementioned databases will be queried for English keywords and their combinations, using the title tag, abstract, and keywords, spanning from 2005 to 2019. The syntax used to search the databases for relevant research will be as follows.

2.2. Criteria for Inclusion and Exclusion

This study will include English studies conducted between 2005 and 2020, which consist of initial studies (such as qualitative, observational, and interventional studies) and secondary studies (such as systematic reviews, narrative reviews, and meta-analyses). The main focus of these studies is to assess the level of disaster preparedness among emergency medical service providers. The inclusion criteria encompass high-quality post-incident reviews and action reports pertaining to significant incidents and disasters found in the grey literature. This includes conference papers, theses and dissertations, websites of recognized authorities, and other sources of grey literature. The publications must be the result of independent investigations. The following studies will be excluded: those that did not report findings on disaster preparedness of EMS providers, those that included EMS providers as part of a sample with other professionals, those that reported findings on EMS providers' preparedness in situations other than emergencies and disasters, those that are not published or do not have the abstract and full text, and those that are book chapters, dissertations/theses, and conference papers.

3. The degree of readiness of EMS to effectively respond to crises and catastrophes

The findings of this analysis suggest that, on general, EMS agencies in the countries examined in the chosen studies are insufficiently equipped to handle disaster response. Nevertheless, a research done by Jadidi et al. revealed that the average readiness score of the Emergency Medical Services (EMS) system in Iran for responding to Ebola was greater, with rates of 63.73% ± 12.77%.[3] Alotaibi and Khan assessed the level of readiness of Emergency Medical Services (EMS) in 13 areas of Saudi Arabia to effectively respond to mass casualty occurrences (MCI). This research demonstrated that, overall, the emergency medical services in Saudi Arabia are insufficiently equipped to handle mass casualty incidents (MCIs).The number 16 is enclosed in square brackets. Maguire et al. investigated the level of readiness of EMS services in a specific US state to effectively react to a large-scale pandemic occurrence. The authors said that the majority of EMS agencies in this state lack comprehensive and official strategies for addressing large-scale bioterrorism or pandemic incidents.[2] Phelps performed another research to examine the level of readiness of the EMS in handling casualties and reacting to threats from a mass-terrorism chemical weapons attack (MTCWA). According to this survey, a mere 6 out of the total EMS services in the area, accounting for just 12% of them, provided their workers with personal protective equipment (PPE). The study's authors said that the EMS providers were ill-equipped to effectively react to MTCWAs.[1] The research conducted by Shirm et al. in 1932 randomly chose EMS organizations in the United States to assess their readiness in providing care for children after mass-casualty situations. The survey revealed that the majority (72.9%) of EMS agencies has a documented strategy for addressing a Mass Casualty Incident (MCI), but only 248 (13.3%) of EMS agencies have developed strategies specifically tailored for pediatric cases. Moreover, this research revealed significant inadequacies in the emergency medical services (EMS) agencies' readiness plans in the United States to handle the medical treatment of children during mass casualty incidents (MCIs). [14]

Jama and Kuisma performed a research in Finland to assess the degree of readiness of EMS systems in responding to chemical mass casualty incidents (MCIs) during the prehospital phase. The findings of their research suggest that Finland's ability to handle chemical mass casualty incidents (MCIs), particularly those involving exposure to cyanide gas, is inadequate. However, there was a high degree of readiness in terms of monitoring and treating people involved in chemical accidents, since bronchodilators, supplementary oxygen, and inhaled corticosteroids were available.The text is enclosed

in the tags. Furbee et al. conducted an evaluation of 768 rural EMS organizations in the USA to assess the level of preparation of rural EMS agencies for crises and disasters. The results of their investigation suggest that several rural EMS services had restricted resources and surge capacity, and are not equipped to handle incidents involving 10 or more patients. Furthermore, there was a lack of readiness to respond to terrorist bombings.[15]

4. Methods to improve the readiness of EMS services in the face of catastrophes

Various approaches to improve the readiness of EMS services in dealing with disasters have been presented in the literature. Alotaibi and Khan proposed ensuring a enough supply of competent EMS staff, which includes medical directors and graduates with paramedic training. Proficient EMS workers get training in disaster response and actively contribute to the development of standards and disaster preparation strategy. [16] Alotaibi and Khan also recommended implementing strategies such as enhancing infrastructure, improving the prehospital care system, increasing public awareness and notification, establishing an effective evaluation system to assess the performance of emergency responders and the quality of pre-hospital medical care, as well as developing and implementing a comprehensive disaster preparedness plan. [16]. Maguire et al. recommend that a way to improve emergency medical services (EMS) response to catastrophes is to establish close collaboration between local EMS agencies and state or national EMS organizations in the development of EMS rules, standards, and procedures. [2]

Maguire et al. (2007) propose several strategies, including: ensuring the safety and support of responders and their families, utilizing alternative methods of prehospital transportation and treatment, expanding the responsibilities of EMS personnel to include additional treatments and prescription of medications, aligning local EMS plans with public health response plans, training individuals from various professions (such as teachers, artists, and business professionals) who are not typically involved in disaster response, coordinating with hospital and local health officers to establish alternative treatment plans and triage methods, and fostering strong relationships with health agencies, emergency management, and key administrators within the local community. [2] Jadidi et al. (2007) suggested that enhancing staff motivation, resources, instructional programs, management, and IT infrastructure has the potential to enhance the level of emergency medical services (EMS) readiness.[2] Phelps has proposed the idea of broadening the responsibilities of EMS personnel to include administering further medical treatments and dispensing drugs (2007). [13] Phelps suggests that in order to enhance EMS preparation, it is important to provide an adequate supply of personal protective equipment (PPE) and allocate money for the provision of required tools and personnel training. [13]

Shirm et al. [14] conducted a research that specifically examined kid prehospital health care in crisis situations. Shirm et al. proposed several strategies for improving disaster preparedness for pediatric victims. These include developing a detailed written plan specifically for the care of children during disasters, actively involving pediatricians in community-level disaster planning, coordinating with local schools and child care centers to discuss emergency planning, implementing a triage protocol specifically designed for pediatric victims, incorporating a local reunification plan into the overall disaster plan, and including pediatric victims in community and regional disaster drills to acquire specialized skills for handling children in emergencies. Jama and Kuisma advocate two crucial preparation strategies: enhancing decontamination readiness and boosting the capabilities of emergency medical services in treating patients harmed by chemicals.[17] In addition, Furbee et al. suggest several measures to enhance the efficiency and effectiveness of day-to-day operations in the EMS. These include maintaining a comprehensive approach to managing disasters, improving communication skills and capabilities among different agencies, increasing the involvement of local EMS agencies in regional planning, and clarifying the roles and responsibilities of local EMS in communicating and collaborating with other local, state, and federal EMS agencies.[15]

5. Discussion

Preparedness is a crucial approach for managing the risks associated with disasters, as outlined in international publications such SFDRR 2015–2030 [6]. Therefore, the readiness of healthcare workers, particularly EMS personnel, is crucial. An analysis of the existing literature reveals that several comprehensive investigations have been carried out on the level of readiness among healthcare professionals in the face of crisis scenarios [2, 14–18]. Currently, no extensive research has been carried out to assess the level of disaster preparation among EMS providers. This review aims to fill this knowledge gap by consolidating the available research in this specific field.

This study will also examine the fundamental aspects of disaster preparation among EMS providers and the tactics to improve their level of readiness. The first stage in creating effective tools to assess the disaster readiness of EMS providers and enhancing their preparedness level involves identifying the crucial aspects of disaster preparedness. Hence, the findings of this research will provide significant insights to EMS officers, administrators, and researchers, aiming to improve the readiness of EMS providers and the overall effectiveness of the EMS system during emergency and catastrophe scenarios.

References

1. G. R. Ciottone, P. D. Biddinger, R. G. Darling et al., *Ciottone's Disaster Medicine*, Elsevier Health Sciences, Amsterdam, Netherlands, 2015.
2. L. J. Labrague, K. Hammad, D. S. Gloe et al., "Disaster preparedness among nurses: a systematic review of literature," *International Nursing Review*, vol. 65, no. 1, pp. 41–53, 2018.
3. G. Sapir, *Extreme Weather Events Affected 60 Million People*, CRED, Geneva, Switzerland, 2018, http://file:///C:/Users/Asus/Downloads/PressReleaseReview2018%20(1).pdf.

4. Coronavirus Cases, 2020, https://www.worldometers.info/coronavirus/.
5. UNISDR, *Proposed Updated Terminology on Disaster Risk Reduction—A Technical Review 2015*, UNISDR, Geneva, Switzerland, 2015, https://www.preventionweb.net/files/45462_backgoundpaperonterminologyaugust20.pdf.
6. UNO, *Framework for Disaster Risk Reduction 2015–2030*, UNDRR, Geneva, Switzerland, 2015, https://www.unisdr.org/files/43291_sendaiframeworkfordrren.pdf.
7. S. Asghar, D. Alahakoon, and L. Churilov, "A comprehensive conceptual model for disaster management," *Journal of Humanitarian Assistance*, vol. 1360, no. 222, pp. 1–15, 2006.
8. S. T. T. Lo, E. Y. Y. Chan, G. K. W. Chan et al., "Health emergency and disaster risk management (health-EDRM): developing the research field within the Sendai framework paradigm," *International Journal of Disaster Risk Science*, vol. 8, no. 2, pp. 145–149, 2017.
9. C. Barton, *The Story of My Childhood*, Oxford, Oxford, UK, 1907.
10. G. Stevens, A. Jones, G. Smith et al., "Determinants of paramedic response readiness for CBRNE threats," *Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science*, vol. 8, no. 2, pp. 193–202, 2010.
11. S. Udoh, *Target Capabilities List: A Companion to the National Preparedness Guidelines*, Department of Homeland Security, Washington, DC, USA, 2007.
12. R. W. Elliott, *Measuring Disaster Preparedness of Local Emergency Medical Services Agencies*, Naval Postgraduate School, Monterey, CA, USA, 2010.
13. D. Moher, L. Shamseer, M. Clarke et al., "Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement," *Systematic Reviews*, vol. 4, no. 1, p. 1, 2015.
14. Phelps S. Mission failure: Emergency medical services response to chemical, biological, radiological, nuclear, and explosive events Prehosp Disaster Med. 2007;22:293–6
15. Shirm S, Liggin R, Dick R, Graham J. Prehospital preparedness for pediatric mass-casualty events Pediatrics. 2007;120:e756–61
16. Furbee PM, Coben JH, Smyth SK, Manley WG, Summers DE, Sanddal ND, et al Realities of rural emergency medical services disaster preparedness Prehosp Disaster Med. 2006;21:64–70
17. Alotaibi MS, Khan AA. Assessing the pre-hospital care preparedness to face mass casualty incident in Saudi Arabia in 2017-2018 Saudi Med J. 2019;40:1032–9
18. Jama TJ, Kuisma MJ. Preparedness of finnish emergency medical services for chemical emergencies Prehosp Disaster Med. 2016;31:392–6