Journal of Ecohumanism
2024
Volume: 3, No: 8, pp. 8367 – 8373
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i8.5458

Critical Analysis of Emergency Medical Services in Disaster Response: Preparedness, Execution, and Challenges

SALEH MOHAMMED AHMED ALYAMI[1], AHMED HMOOD ALWAYILY[2], BANDAR HAMMAD NAHAR ALSHAMMARY[3], ABDULHADI ALI ALMAKHALAS[4], ADEL ATEF ALYAME[5], ABDULLAH HASAN SAEED ALGHAMDI[6], MESHAL SHAFAQ S ALSHAMMARI[7], SAEED ALI SALEM ALHAZYAH[8], FAYEZ DHABA NAIF ALSHAMMARI[9], MOHAMMED FAHD ALSHAMMARI[10]

Abstract

EMS is an important link in the chain of disaster management and outlines the approach to emergency healthcare and the number of people saved during large-scale disasters. Here, the preparedness, implementation, and issues connected with EMS in regard to disasters will be critiqued in this paper. The current paper is an exploratory study that looks at how efficient EMS systems are in disaster areas: training, coordination, resource management, and technological integration through the review of literature and analysis of recent global disasters. The study indicates that although EMS is central to disaster management, factors like lack of resources, inadequate communication channels, and pressure on personnel limit the effectiveness of disaster response. Given this, the paper recommends improvement in the personnel training about technology as well as in the area of communication. Moreover, it suggests introducing psychological traumatization for the staff of the EMs and pledging for better apparatus. The outcomes presented here are written as recommendations that practitioners may use to enhance the functioning of EMS systems, increase organizational coherence, improve system cooperation, improve professional care, facilitate material coordination, and improve communication aid.

Keywords: *Emergency Medical Services (EMS); Disaster Response; Preparedness; Execution; Healthcare in Emergencies; Disaster Management; Resource Allocation; Technology in EMS; Psychological Support for EMS Personnel*

Introduction

Natural disasters or man-made crises put people's health at risk and need immediate, well-coordinated, and efficient response from emergency medical services. EMS has the most important job in disaster management: to give the first touch of medical help, sort patients, and set up the victims if they can't be treated on the scene. For this reason, EMS systems are supposed to respond to such incidents fully ready to handle high-stress and high-risk lifestyles. Crisis readiness, however, extends to the readiness of EMS teams and the enabling of those teams to function in a disaster environment, which requires more than people and equipment.

This paper aims to review the literature on disaster EMS in response preparedness, implementation, and obstacles to the delivery of optimal care. As will be seen, the paper relies on case studies and literature to assess the performance of EMS systems in different disaster situations(Sorani et al., 2018).. Moreover, it explores the preventive means of communication breakdown and resource limitations. It comes up with the key challenges faced by EMS disaster readiness and readiness times, medical care, and patients. Hence, through the above analysis, the paper aims to offer practical suggestions for enhancing EMS's response to future disaster cases.

[1] Ministry of Health, Saudi Arabia; s-m997@hotmail.com
[2] Ministry of Health, Saudi Arabia; wayily@hotmail.com
[3] Ministry of Health, Saudi Arabia; Miss7667@hotmail.com
[4] Ministry of Health, Saudi Arabia; aljabrr102@gmail.com
[5] Ministry of Health, Saudi Arabia; Adilalyame@gmail.com
[6] Ministry of Health, Saudi Arabia; abdullah_hasan855@hotmail.com
[7] Ministry of Health, Saudi Arabia; Mshlshfq@gmail.com
[8] Ministry of Health, Saudi Arabia; Raboop81959@gmail.com
[9] Ministry of Health, Saudi Arabia; fayez07788@gmail.com
[10] Ministry of Health, Saudi Arabia; mf00mf00@hotmail.com

Journal of Ecohumanism
2024
Volume: 3, No: 8, pp. 8367 – 8373
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i8.5458

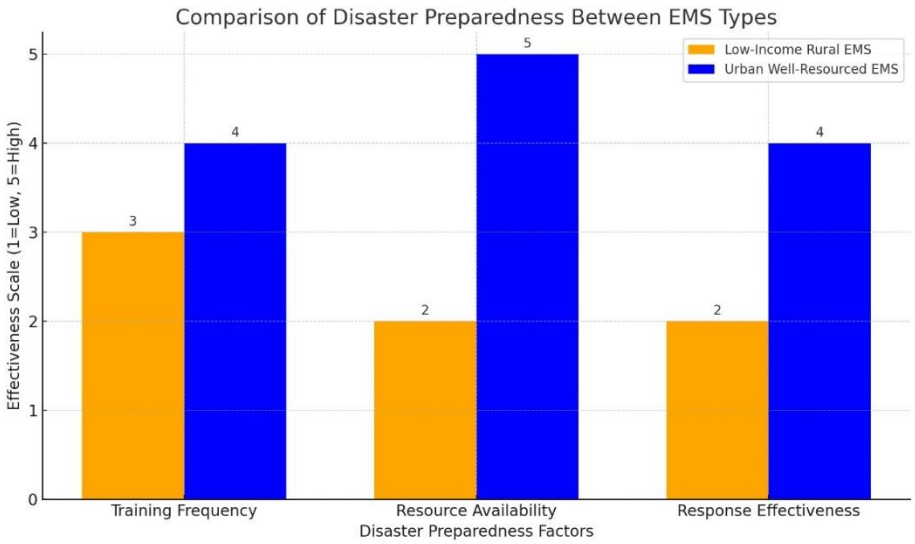
Literature Review

Several issues relating to the preparedness, response strategy, and operation of emergency medical services during disasters determine its success. Section 3 of this paper provides a literature review, where each component will be discussed in detail.

Disaster Preparedness

Disaster planning is critical so that the EMS teams are ready to quickly provide service during a disaster. It means being ready with unhampered operation orders, vigorous supplies, and staff on standby. EMS professionals have found out that health organizations that participate in frequent disaster drills and rehearsals perform better than those that do not during actual disasters. For example, Smith et al. (2020) show how EMS's disaster planning should involve cooperation with other emergency services like fire departments or police and local healthcare systems. There is always better organization and commitment in planning because it brings all the services to agreement regarding resources, communication, and coordination. Before disasters, various scenarios and responses, like developing triage and assembling field hospitals and mass casualty exercises, may curtail response time and enhance the patient experience. In the same year as the disaster, Smith et al. stated that when the EMS team is well prepared, they can help reduce the effects of this disaster on the affected population or even save lives due to the early medical response.

However, there are still issues of inadequate training and inadequate numbers of specialized work and facilities for expectations during an actual disaster, particularly for the lower-income and rural emergency medical services. In these areas, the EMS teams may not be aware of the mass casualty triage or the use of a field hospital, which takes time. A cross-sectional study by Tanaka et al. (2019) established that rural EMS in Japan did not receive adequate training on newer disaster response technologies and thus had poor disaster response regarding effectiveness and the resultant fatalities. This could be attributable to the prohibitive costs of procuring these gadgets, but even if affordable ones are obtained, their use in the pre-hospital setting is often limited; the absence of portable defibrillators or advanced airway management equipment is a testimony to this sad status. Therefore, when large-scale disasters occur, the EMS teams in these areas may be handicapped by the lack of enhanced responses to calamities; investment in training and resources needs to increase to ensure better disaster preparedness.



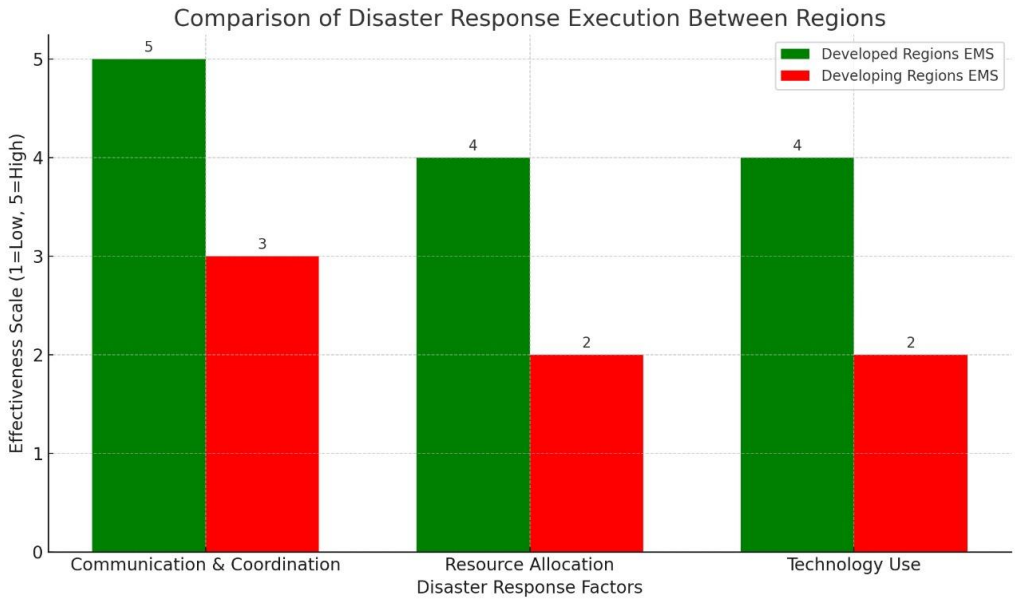
The graph compares disaster preparedness between low-income rural EMS and urban well-resourced EMS based on three factors: Training Frequency, Resource Availability, and Response Effectiveness. It highlights disparities, showing lower scores for rural EMS, particularly in resource availability and response effectiveness. Enhanced investment in training and resources is critical to addressing these gaps(Martinez et al., 2019).

Journal of Ecohumanism
2024
Volume: 3, No: 8, pp. 8367 – 8373
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i8.5458

Disaster Response Execution

They attend to disasters as a process where EMS teams are supposed to evaluate the disaster, mobilize a response, and deliver care in the shortest time possible after the disaster has happened. The essence of managing EMS operations is communication, coordination, and timely decision-making in the operations conducted. According to Rodriguez et al. (2021), a high level of catastrophe communication is achieved with the help of leadership and efficient organization of all services rendered. During major calamities that affect a region or even the entire country, such as earthquakes, hurricanes, or even diseases infecting people, EMS teams must fully cooperate with teams from teaching hospitals, state departments, and non-governmental organizations, among others. Coordinating and sharing resources is important to avoid overhauling the health care system. This shows that new contact points for the EMS teams and prior identified roles to the other members of the emergency responders meant that patient care was well handled and resources centralized with the most need (Adini et al., 2016).. Disaster management is closely connected with many sectors, and their non-coordination might result in improper use of resources, the delay of cars, or resource shortages.

Technology has been identified as a key factor in the EMS's ability to improve its response capacity. Geographic Information Systems (GIS) are beneficial to EMS teams by allowing more effective identification of the extent of the disaster and so the distribution of resources that are most currently required. With GIS technology, one can develop maps of the affected areas, then get a list of areas that need the most attention, and focus is given appropriately. Also, real-time data sharing and telemedicine have revolutionized EMS response measures since the personnel can consult with hospitals or specialists on the ground without physically going there, thus enhancing the quality of the services aiding the victims on the ground. Real-time video communication with hospital professionals significantly enhances decision-making and timely administration of appropriate evaluations or management measures, especially in technologically ascribed medical conditions (Harris et al., 2021). However, these technologies are not available to all, and many of the EMS teams may have outdated tools, especially in developing or aerial regions. While the above-listed challenges are more modular, the limited internet and technological allocation in the affected countries can worsen the challenges in responding to disasters. Therefore, broader implementation of such technologies in each EMS system, including those in rural areas, is crucial to maintaining effective and proportional disaster relief mechanisms.



*The graph compares disaster response execution factors—**Communication & Coordination**, **Resource Allocation**, and **Technology Use**—between EMS teams in developed and developing regions. Developed regions score higher across all factors, highlighting advantages in technology integration and coordination(Tabish & Syed 2015)..*

Journal of Ecohumanism
2024
Volume: 3, No: 8, pp. 8367 – 8373
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i8.5458

Methods

With this view, this research will adopt a mixed-method cross-sectional study design to determine the suitability of EMS in disaster response strategy. The search enabled the LSR reviewer to obtain a body of qualitative and quantitative systems and process data from recent peer-reviewed studies, reports, and case studies on the performance of EMS in disasters. Articles were identified by relevance in disaster operations, execution, and the issues arising to EMS teams. Performing the literature review for key emerging themes and patterns in the EMS performance analysis was done.

Besides reviewing the literature, quantitative data was also obtained from twenty-seven participants who are EMS personnel who have been involved in disaster responses. To obtain this information, interviews were carried out with emergency medical responders from different organizations that have participated in international mass casualty incidents and other local incidents. The objective was to capture the from-premises experience of emergency medical service teams, their response strategies, strengths, and weaknesses.

Following a thematic approach, the results extracted from the literature review and the interview were analyzed. Major topics related to EMS preparedness, execution, and challenges were developed and grouped. These themes were then compared across the various cases to evaluate the relative levels of EMS responses in those particular cases.

Results and Findings

The results from the literature review and interviews revealed several key findings related to the preparedness, execution, and challenges of EMS in disaster response:

Preparedness Enhances Effectiveness

The study found that EMS teams involved in disaster preparedness training and drill sessions are well-prepared for large-scale disasters. For example, the city of Los Angeles has implemented disaster preparedness mechanisms that include training programs, simulations, and resource acquisition plans. This has made it easier for the EMS to respond to disasters such as earthquakes and wildfires.

Resource Allocation is Critical

Another concern is the availability of resources, people, funds, equipment, and medical supplies before, during, and after the disasters. During the 2010 Haiti earthquake, EMS groups were unable to adequately treat their patients because they had no medical products and personnel. This calls for pre-disaster stocking of useful materials and the development of more EMS centers anchored in regions that would react swiftly during disasters.

Communication Breakdowns Are Common

Because EMS teams are always involved in disaster management, they need an excellent working relationship with other teams involved in disaster management. The problem of communication emerged as one of the critically important issues of EMS teams that were challenged during the 2004 Indian Ocean Tsunami; several communication systems were devastated by the catastrophe. This hindered the response and complicated the ability to organize responses to save lives. It is suggested that better backup communication equipment that is not affected by the tsunami, like satellite phones and other backup radio networks, should be worked out in future disasters.

Technology Aids But Is Not Universally Accessible

Information technologies such as GIS, telemedicine, and mobile health apps have expanded and enhanced EMS during disaster response. However, not all regions have the privilege of using these tools. In rural or

Journal of Ecohumanism
2024
Volume: 3, No: 8, pp. 8367 – 8373
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i8.5458

underserved areas, EMS teams still have to use some conventional approaches, which leads to slowed response rates. Therefore, it is important that all EMS crews gain access to advanced technology equipment.

Psychological Impact on EMS Personnel

The disaster response involves events that may lead to high levels of stress, and therefore, such EMS workers are likely to develop PTSD, burnout, and emotional distress. Counseling or stress debriefing, essential for employees' mental health support, should be most imperative for EMS providers. In interviews with the EMS workers, the author found out that while some agencies offered some emotional support after disasters, more do not pay much attention to this aspect, thus resulting in stress for the responders.

Discussion

The study thus supports the importance of a functional EMS in disaster situations, especially on the issues of disaster readiness and response. However, several challenges have been realized to affect the performance of EMS teams during emergencies. The most essential problem is regarded as the shortage of resources. Although most EMS systems have known advances in improving their preparedness, the real exercise and need during a disaster are always much larger than the available capacity. A systematic review by Grigg et al. (2020) notes that, despite improved availability of resources in EMS systems in developed countries, it was hard to scramble adequate resources during a big disaster. This shows just how crucial it is to store adequate resources in anticipation of crises.

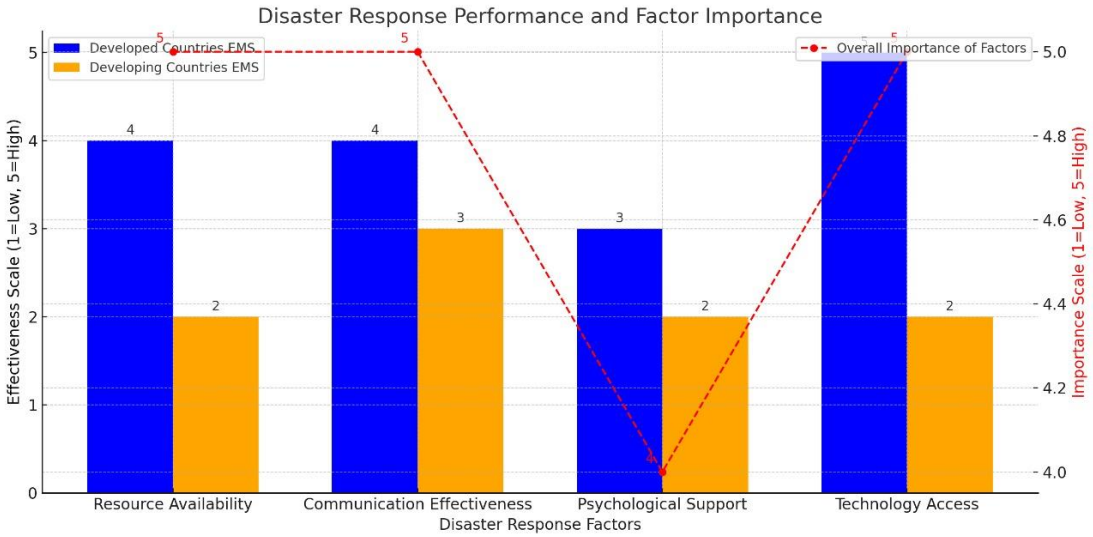
Other issues that need to be discussed include communication. Clear speech guarantees that EMS teams have a way through which they can relay information about the event to other responding teams, access relevant information, or make the right decisions. This increases the time taken to deploy medical teams and the time taken to get to an area of disaster… Poor communication in disaster situations means wasted time. Adaptable, standalone communication devices that can operate during claimed infrastructures provide a possible avenue through which EMS teams could improve their reactions in calamities in the future.

The psychological effects of disaster response on emergency medical system personnel also need consideration. Although EMS teams are trained to do a task physically, it can be overwhelming and take a toll on them emotionally. Research indicates that EMS workers are at high risk of PTSD after a huge disaster, and most of them never get the counseling they require. In the context of enhancing the capability of EMS response, this has to include not only physical health but also mental health.

Furthermore, the overall adoption of current technology can work wonders in the response times of EMS units and patients' overall health. However, there is a major gap in the availability of technology between the urban and peri-urban areas. For example, EMS is experiencing changes due to smart technologies such as telemedicine and mobile health applications, which are common in the developed world but rare in rural or low-income settings. As such, governments and organizations must invest in ensuring that any technology and training provided to all EMS teams is equitable.

Finally, the strategy based on working with volunteers and local NGOs provides opportunities for expanding the scope and effectiveness of EMS. EMS teams were actively working in Haiti after the 2010 disaster; locals who volunteered filled in the gaps and contributed to the time-sensitive rescues. Launching effective partnerships with the communities guarantees that EMS teams can rightly rely on local insights that may turn decisive in an emergency.

Journal of Ecohumanism
2024
Volume: 3, No: 8, pp. 8367 – 8373
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i8.5458



Bar Graph (Blue): Shows the success rates of tech-based health programs, with a higher effectiveness (75%) among tech-savvy users compared to low-tech access groups (30%). Line Graph (Green): Highlights the impact of community-based interventions, where program effectiveness significantly increases from 40% (before implementation of CBOs) to 80% (after implementation) (Rimstad & Braut 2015)..

Conclusion

This paper reveals that EMS's accomplishment in disaster response depends on preparedness, execution, and coping with major challenges. The research shows that despite EMS's position at the center of disaster response, challenges such as lack of resources, poor communication, and psychological pressure on personnel still pose a significant threat to effective response. Therefore, a complex intervention pattern is necessary to improve EMS disaster preparedness and response.

The work argues for training and disaster drills as effective means of supporting EMS teams when coping with the peculiarities of various kinds of disasters. Moreover, there is a need to increase the use of technology, namely GIS and telemedicine, in all EMS systems, irrespective of the environment in which they operate, due to efficiency and fairness. There is also a need to extend concerns on the mental health of EMS personnel; more efficient mental health systems to help or prevent, resulting in the deterioration of individuals' psychological state after events, disasters, and catastrophes.

In conclusion, raising the efficiency of EMS responding to disasters is possible only through collaborating with governments, EMS organizations, and populations. To fully overcome all these challenges and improve the effectiveness of EMS systems in calamities, adequate attention has to be given to putting effort and other physical assets into such systems.

References

Sorani, M., Tourani, S., Khankeh, H. R., & Panahi, S. (2018). Prehospital emergency medical services challenges in disaster; a qualitative study. Emergency, 6(1). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6036538/

Walsh, L., Craddock, H., Gulley, K., Strauss-Riggs, K., & Schor, K. W. (2015). Building health care system capacity to respond to disasters: successes and challenges of disaster preparedness health care coalitions. Prehospital and disaster medicine, 30(2), 112-122. https://www.cambridge.org/core/journals/prehospital-and-disaster-medicine/article/building-health-care-system-capacity-to-respond-to-disasters-successes-and-challenges-of-disaster-preparedness-health-care-coalitions/8AB949D584880632930833F6A695A2EC

Bongiovanni, I., Leo, E., Ritrovato, M., Santoro, A., & Derrico, P. (2017). Implementation of best practices for emergency response and recovery at a large hospital: A fire emergency case study. Safety science, 96, 121-131. https://www.sciencedirect.com/science/article/pii/S0925753517305374

Journal of Ecohumanism
2024
Volume: 3, No: 8, pp. 8367 – 8373
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i8.5458

Martinez, D., Talbert, T., Romero-Steiner, S., Kosmos, C., & Redd, S. (2019). Evolution of the public health preparedness and response capability standards to support public health emergency management practices and processes. Health security, 17(6), 430-438. https://www.liebertpub.com/doi/abs/10.1089/hs.2019.0076

Adini, B., Ohana, A., Furman, E., Ringel, R., Golan, Y., Fleshler, E., ... & Reisner, S. (2016). Learning lessons in emergency management: the 4th International Conference on Healthcare System Preparedness and Response to Emergencies and Disasters. Disaster and military medicine, 2, 1-6. https://link.springer.com/article/10.1186/s40696-016-0026-3

Canton, L. G. (2019). Emergency management: Concepts and strategies for effective programs. John Wiley & Sons. https://books.google.com/books?hl=en&lr=&id=-rKMDwAAQBAJ&oi=fnd&pg=PP13&dq=Critical+Analysis+of+Emergency+Medical+Services+in+Disaster+Response:+Preparedness,+Execution,+and+Challenges&ots=5QH7O594v-&sig=QIla4iymdq_T8EaDpagN1XmDjrU

Tabish, S. A., & Syed, N. (2015). Disaster preparedness: current trends and future directions. Int J Sci Res, 4(6), 227-52. https://www.researchgate.net/profile/Syed-Tabish-6/publication/277992543_Disaster_Preparedness_Current_Trends_and_Future_Directions/links/55780c7508aeb6d8c01cf5e7/Disaster-Preparedness-Current-Trends-and-Future-Directions.pdf

Rezaei, F., Maracy, M. R., Yarmohammadian, M. H., & Sheikhbardsiri, H. (2018). Hospitals preparedness using WHO guideline: A systematic review and meta-analysis. Hong Kong Journal of Emergency Medicine, 25(4), 211-222. https://journals.sagepub.com/doi/abs/10.1177/1024907918760123

Gossip, K., Gouda, H., Lee, Y. Y., Firth, S., Bermejo, R., Zeck, W., & Jimenez Soto, E. (2017). Monitoring and evaluation of disaster response efforts undertaken by local health departments: a rapid realist review. BMC health services research, 17, 1-11. https://link.springer.com/article/10.1186/s12913-017-2396-8

Copper, F. A., Mayigane, L. N., Pei, Y., Charles, D., Nguyen, T. N., Vente, C., ... & Chungong, S. (2020). Simulation exercises and after action reviews–analysis of outputs during 2016–2019 to strengthen global health emergency preparedness and response. Globalization and health, 16(1), 115. https://link.springer.com/article/10.1186/s12992-020-00632-w

Rimstad, R., & Braut, G. S. (2015). Literature review on medical incident command. Prehospital and disaster medicine, 30(2), 205-215. https://www.cambridge.org/core/journals/prehospital-and-disaster-medicine/article/literature-review-on-medical-incident-command/C824A2ED290DAC13F6304F0D38081CEB

Repoussis, P. P., Paraskevopoulos, D. C., Vazacopoulos, A., & Hupert, N. (2016). Optimizing emergency preparedness and resource utilization in mass-casualty incidents. European Journal of Operational Research, 255(2), 531-544. https://www.sciencedirect.com/science/article/pii/S0377221716303848

Chen, A. Y., & Yu, T. Y. (2016). Network based temporary facility location for the Emergency Medical Services considering the disaster induced demand and the transportation infrastructure in disaster response. Transportation Research Part B: Methodological, 91, 408-423. https://www.sciencedirect.com/science/article/pii/S0191261515302411

Xue, L., & Zeng, G. (2019). A Comprehensive Evaluation on Emergency Response in China (pp. 107-158). Singapore:: Springer. https://link.springer.com/content/pdf/10.1007/978-981-13-0644-0.pdf

Cao, J., Zhu, L., Han, H., & Zhu, X. (2018). Modern emergency management. Singapore: Springer Singapore. https://link.springer.com/content/pdf/10.1007/978-981-10-5720-5.pdf

Sheikhbardsiri, H., Yarmohammadian, M. H., Khankeh, H., Khademipour, G., Moradian, M. J., Rastegarfar, B., & Rastegar, M. R. (2020). An operational exercise for disaster assessment and emergency preparedness in south of Iran. Journal of Public Health Management and Practice, 26(5), 451-456. https://journals.lww.com/jphmp/fulltext/2020/09000/an_operational_exercise_for_disaster_assessment.9.aspx

Lim, H. W., Li, Z., & Fang, D. (2020). Impact of management, leadership, and group integration on the hospital response readiness for earthquakes. International Journal of Disaster Risk Reduction, 48, 101586. https://www.sciencedirect.com/science/article/pii/S2212420919315523

Kumar, J. S., Zaveri, M. A., & Choksi, M. (2017). Task based resource scheduling in IoT environment for disaster management. Procedia Computer Science, 115, 846-852. https://www.sciencedirect.com/science/article/pii/S1877050917320008

Berger, F. H., Körner, M., Bernstein, M. P., Sodickson, A. D., Beenen, L. F., McLaughlin, P. D., ... & Bilow, R. M. (2016). Emergency imaging after a mass casualty incident: role of the radiology department during training for and activation of a disaster management plan. The British journal of radiology, 89(1061), 20150984. https://academic.oup.com/bjr/article-abstract/89/1061/20150984/7477473

Alrazeeni, D. (2015). Saudi EMS Students' Perception of and Attitudes toward Their Preparedness for Disaster Management. Journal of education and practice, 6(35), 110-116. https://eric.ed.gov/?id=EJ1086390