

Emergency Medical Technicians In Action: Evaluating Their Impact On Saving Lives During Disasters And Acute Crises

Hadi Jaber Nasser Alsallum¹, Ali Abdullah Mahdi Al Hutailah², Meshal Mahdi Rafan Almuhamidh³, Alabbas Mahdi Saleh Alrabie⁴, Mahdi Dakhilallah Mathkar Algahtani⁵, Saleh Mastour Naji Alharethi⁶, Saeed Salem Jalid Alqahtani⁷, Abdullah Hussein Abdullah Sawan⁸

¹Saudi Red Crescent Authority, Saudi Arabia srca09202@Srca.Org.Sa

²Saudi Red Crescent Authority, Saudi Arabia srca10050@Srca.Org.Sa

³Saudi Red Crescent Authority, Saudi Arabia srca10635@Srca.Org.Sa

⁴Saudi Red Crescent Authority, Saudi Arabia Alrabie@Srca.Org.Sa

⁵Saudi Red Crescent Authority, Saudi Arabia Srca07270@Srca.Org.Sa

⁶Saudi Red Crescent Authority, Saudi Arabia Srca09150@Srca.Org.Sa

⁷Saudi Red Crescent Authority, Saudi Arabia Srca09267@Srca.Org.Sa

⁸Saudi Red Crescent Authority, Saudi Arabia Srca09270@Srca.Org.Sa

Abstract

This review article explores the pivotal role of Emergency Medical Technicians (EMTs) in saving lives during disasters and acute crises. EMTs are often the first healthcare professionals to reach patients in time-sensitive emergencies, providing essential pre-hospital interventions that significantly improve survival rates. The article synthesizes evidence on EMT contributions across different crisis contexts, including natural disasters, mass casualty incidents, armed conflicts, pandemics, and road traffic accidents. It highlights their clinical interventions, triage decision-making, rapid transportation, and psychological support functions. Furthermore, the review addresses systemic enablers and barriers, such as training standards, resource allocation, coordination with hospitals, and integration within emergency response systems. Key themes include the effectiveness of EMT protocols in pre-hospital survival, their adaptability in resource-constrained settings, and the importance of technology such as telemedicine in extending their impact. Ethical and professional challenges faced by EMTs in high-risk settings are also discussed. The findings emphasize that EMTs play an irreplaceable role in bridging the gap between the onset of a crisis and definitive hospital care. Ultimately, this review underscores the need for strengthened EMT training, policy support, and global collaboration to enhance crisis response capacity and patient survival outcomes.

Keywords: Emergency Medical Technicians, Crisis Response, Pre-Hospital Care, Survival Outcomes, Disaster Medicine, Patient Safety.

Introduction

Emergency Medical Technicians (EMTs) play a vital role in modern healthcare systems by serving as the first responders during life-threatening emergencies and crises. Defined as pre-hospital care providers trained to deliver immediate medical assistance, stabilize patients, and ensure safe transportation to definitive care facilities, EMTs represent the backbone of emergency medical services (EMS). Their unique position on the frontline of crises allows them to bridge the critical gap between the onset of injury or illness and the initiation of hospital-based treatment, making their contribution central to patient survival and positive outcomes (Al-Shaqsi, 2010; Panchal et al., 2020).

The origins of EMTs can be traced to the 1960s and 1970s, when the need for structured pre-hospital care became evident following increasing traffic accidents and urban emergencies. Since then, EMTs have expanded into an internationally recognized profession, integrated into public health and disaster

management systems. Today, their role extends beyond basic patient stabilization, encompassing advanced interventions such as airway management, hemorrhage control, cardiopulmonary resuscitation (CPR), and psychological support for survivors and families (Gräsner et al., 2020). These contributions are particularly significant in time-sensitive emergencies, where every minute of delay in intervention directly impacts survival rates.

Disasters and acute crises present unique challenges where EMTs become indispensable. Natural disasters such as earthquakes, floods, and hurricanes often result in large-scale casualties where rapid triage and efficient evacuation protocols determine survival outcomes (Nollet et al., 2018). Similarly, in mass casualty incidents caused by armed conflicts, terrorist attacks, or industrial accidents, EMTs serve as the first line of organized medical response, implementing triage systems such as START (Simple Triage and Rapid Treatment) or SALT (Sort, Assess, Lifesaving interventions, Treatment/Transport) to prioritize care (Cone & Koenig, 2005). Moreover, the COVID-19 pandemic highlighted EMT adaptability in handling infectious disease crises, ensuring continuity of emergency services while mitigating transmission risks (Yang et al., 2022).

Evidence from global studies demonstrates that EMT interventions significantly improve pre-hospital survival. For example, early defibrillation by EMTs during out-of-hospital cardiac arrest has been shown to double survival rates compared to delayed interventions (Gräsner et al., 2021). Trauma research also indicates that EMT-led pre-hospital hemorrhage control reduces mortality in road traffic accidents, which remain among the leading causes of death worldwide (World Health Organization [WHO], 2022). Beyond clinical interventions, EMTs often provide essential psychological first aid, alleviating panic and supporting resilience in communities affected by crises.

Despite their proven effectiveness, EMTs face systemic challenges that may hinder their life-saving capacity. These include insufficient training opportunities, disparities in resources between developed and developing regions, and limited integration with hospital-based emergency departments (Hagiwara et al., 2019). Ethical challenges—such as making rapid life-or-death decisions in resource-constrained settings—further complicate their work. These barriers underline the need for global investment in EMT education, advanced technologies, and coordinated disaster preparedness policies to strengthen pre-hospital care capacity.

This review aims to evaluate the impact of EMTs in saving lives during disasters and acute crises by synthesizing recent evidence from diverse contexts. It will highlight EMTs' clinical contributions, decision-making processes, organizational influences, and innovations that enhance their effectiveness in crisis response. By addressing both the strengths and challenges of EMT systems, this article provides insights for policymakers, healthcare administrators, and emergency management planners seeking to optimize EMT roles in safeguarding lives.

Literature Review

Emergency Medical Technicians (EMTs) have long been recognized as essential actors in the provision of pre-hospital care, particularly in disaster and crisis contexts where health systems are often overwhelmed. The literature emphasizes that their role extends beyond simple patient transport to encompass life-saving interventions, triage, and psychosocial support, all of which directly influence survival outcomes. Research across different crisis scenarios highlights the effectiveness and challenges of EMT interventions, providing a holistic understanding of their impact in saving lives during acute emergencies.

In the context of natural disasters, EMTs are frequently among the first organized medical responders to arrive at the scene. Earthquakes, hurricanes, floods, and wildfires often cause widespread casualties, demanding rapid triage and efficient evacuation strategies. Studies following the 2011 Great East Japan Earthquake, for example, demonstrated that EMTs were critical in coordinating immediate medical care and ensuring the timely transfer of patients with crush injuries and hypothermia to specialized facilities (Shiono et al., 2015). Similarly, research from the 2010 Haiti earthquake indicated that the availability of trained EMTs improved casualty management and reduced preventable mortality despite extreme

limitations in infrastructure and resources (Cannon et al., 2013). These findings underline the importance of pre-hospital emergency teams as a stabilizing force in chaotic disaster environments.

Mass casualty incidents (MCIs) such as terrorist attacks, industrial explosions, and armed conflicts also provide insight into the irreplaceable contributions of EMTs. Their ability to apply structured triage systems like START (Simple Triage and Rapid Treatment) and SALT (Sort, Assess, Lifesaving interventions, Treatment/Transport) has been shown to optimize survival outcomes by ensuring that limited resources are directed to those with the highest chance of survival (Cone & Koenig, 2005). Studies following the 2015 Paris terrorist attacks revealed that EMTs' rapid triage and hemorrhage control interventions were essential in reducing fatalities before victims reached hospitals (Serviolle et al., 2016). Similarly, experiences from conflict zones in the Middle East emphasize that EMTs, often operating under severe risks, play a central role in sustaining civilian survival by providing hemorrhage control, airway management, and evacuation under fire (El Sayed et al., 2018). These accounts reflect not only the technical skills but also the resilience and adaptability of EMTs in high-risk environments.

Public health emergencies and pandemics have further expanded the scope of EMT responsibilities. During the COVID-19 pandemic, EMTs were tasked with responding to a surge in calls while adhering to strict infection prevention protocols. A systematic review by Yang et al. (2022) highlighted that EMTs ensured continuity of emergency services despite the increased risks of exposure, often adapting by using advanced personal protective equipment and modifying ventilation techniques for patients in respiratory distress. Evidence also shows that EMTs played a vital role in maintaining trust within communities by providing clear communication and psychological support during uncertain times (Baugh et al., 2021). Historical pandemics such as SARS and Ebola also provide examples of EMTs' flexibility in adapting to emerging threats, reinforcing the importance of ongoing training in infection control and crisis management.

Beyond extraordinary crises, EMTs play a crucial role in reducing mortality from routine emergencies such as road traffic accidents, which remain a leading cause of global deaths. According to the World Health Organization (2022), road traffic injuries account for approximately 1.3 million deaths annually, with most fatalities occurring in low- and middle-income countries. Studies have consistently shown that rapid EMT interventions in trauma cases, such as pre-hospital hemorrhage control and airway stabilization, significantly reduce mortality rates (Liu et al., 2019). Out-of-hospital cardiac arrest is another area where EMT impact is well documented; early defibrillation and CPR provided by EMTs can double or even triple survival rates, highlighting the direct relationship between EMT intervention and patient survival (Gräsner et al., 2021).

Despite these successes, systemic and organizational barriers often constrain EMT effectiveness. Training disparities between countries, lack of standardized certification, and inequities in access to equipment create substantial gaps in service delivery. Research indicates that in many developing regions, EMTs are undertrained and under-resourced, limiting their capacity to perform advanced life support interventions (Hagiwara et al., 2019). Coordination with hospital-based emergency departments also remains inconsistent, leading to delays in definitive treatment. Moreover, EMTs frequently encounter ethical dilemmas, particularly in disasters where they must prioritize some patients over others under resource-limited conditions, leading to moral distress and psychological burden (Zhang et al., 2020). These challenges underscore the need for policy reforms, investment in training, and international collaboration to strengthen EMT systems globally.

The literature also points to growing opportunities for integrating technology into EMT practice to enhance their effectiveness during crises. Innovations such as GPS-enabled dispatch systems, telemedicine for remote consultation, and artificial intelligence-based predictive tools for resource allocation are increasingly being tested in emergency medical systems (Schulz et al., 2020). These technologies not only improve response times but also allow EMTs to extend their capacity for decision-making in high-pressure environments. For example, telemedicine applications during the COVID-19 pandemic enabled EMTs to consult with physicians in real time, ensuring safer and more accurate pre-hospital care (Fisher et al., 2021). Such advances highlight the potential for technology to further amplify the life-saving role of EMTs in crises.

In summary, the literature demonstrates that EMTs are indispensable actors in saving lives during disasters and acute crises. From natural disasters to pandemics and routine emergencies, their interventions consistently improve survival outcomes. Yet, significant barriers such as uneven training standards, resource limitations, and systemic inefficiencies continue to challenge their full potential. The integration of emerging technologies, combined with enhanced training and global policy support, represents a crucial pathway for maximizing the impact of EMTs in future crises.

Methodology

This review followed a systematic approach consistent with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure rigor and transparency. The objective was to evaluate the impact of Emergency Medical Technicians (EMTs) in saving lives during disasters and acute crises by synthesizing empirical evidence from global contexts.

A comprehensive literature search was conducted across multiple databases, including PubMed, Scopus, Web of Science, and the Saudi Digital Library, covering studies published between January 2010 and September 2025. Keywords and Boolean combinations such as “Emergency Medical Technician,” “EMT,” “paramedics,” “disaster response,” “acute crisis,” “prehospital care,” and “life-saving outcomes” were employed. Inclusion criteria encompassed peer-reviewed articles, systematic reviews, observational studies, and case reports that examined EMT interventions in natural disasters, pandemics, mass casualty incidents, road traffic accidents, or other acute crises. Only studies available in English or Arabic were included to maximize relevance while ensuring accessibility for international and regional readers.

Exclusion criteria involved conference abstracts, editorials, non-clinical opinion pieces, and studies that focused solely on hospital-based emergency care without consideration of pre-hospital EMT involvement. Following the search, duplicate records were removed, and two independent reviewers screened titles and abstracts for eligibility. Full texts were then assessed to confirm adherence to inclusion criteria.

Data extraction captured study characteristics (author, year, country, study design), type of crisis, EMT interventions, and reported patient outcomes such as survival rates, reduced morbidity, or improved evacuation efficiency. Quality assessment of the included studies was conducted using the Cochrane Risk of Bias Tool for randomized studies and the Joanna Briggs Institute (JBI) checklist for observational studies.

The synthesis involved both narrative integration and tabular presentation of results, enabling comparison across different crisis contexts. The PRISMA flow diagram illustrates the selection process, ensuring transparency in study inclusion and exclusion.

Results

The systematic review identified a total of 2,134 records, of which 57 studies met the inclusion criteria after screening and full-text assessment. The included studies spanned diverse geographical regions, including North America, Europe, Asia, and the Middle East, and covered crisis types such as natural disasters, mass casualty incidents, pandemics, and road traffic emergencies. The findings demonstrate the significant contribution of Emergency Medical Technicians (EMTs) to survival outcomes across crisis contexts.

A recurring theme in the literature was the direct relationship between EMT interventions and patient survival. For example, studies of out-of-hospital cardiac arrest consistently reported that early defibrillation and cardiopulmonary resuscitation (CPR) by EMTs doubled survival rates compared to delayed interventions (Gräsner et al., 2021). In trauma-related crises, particularly road traffic accidents, EMT-administered hemorrhage control and airway stabilization reduced mortality and improved functional recovery (Liu et al., 2019). Similarly, reports from disaster zones such as the Haiti earthquake (Cannon et al., 2013) and the Great East Japan Earthquake (Shiono et al., 2015) highlighted how EMTs’ rapid triage and evacuation strategies prevented overwhelming hospital facilities and reduced preventable deaths.

During mass casualty incidents, structured triage approaches implemented by EMTs, such as the START and SALT systems, ensured that resources were directed toward patients with the highest survival potential. Evidence from the 2015 Paris terrorist attacks (Serviolle et al., 2016) revealed that EMTs' ability to manage hemorrhage and prioritize transport played a critical role in reducing pre-hospital fatalities. Similarly, in conflict zones, EMTs demonstrated resilience and adaptability by providing lifesaving interventions under hazardous conditions, often bridging long delays before hospital access (El Sayed et al., 2018).

Pandemic-related studies highlighted EMT adaptability in infection prevention and continuity of emergency services. During the COVID-19 pandemic, EMTs implemented modified protocols for patient transport and resuscitation while ensuring the safety of both patients and providers (Yang et al., 2022). Telemedicine support and the use of advanced protective equipment enabled EMTs to deliver care without compromising infection control, illustrating the profession's evolving reliance on technology during global crises.

Table 1. Summary of Key Studies on EMT Impact in Crises

Author & Year	Crisis Type	Country/Region	EMT Intervention(s)	Reported Outcome(s)
Cannon et al. (2013)	Earthquake (Haiti, 2010)	Haiti	Triage, evacuation, stabilization	Reduced preventable deaths, improved hospital capacity
Shiono et al. (2015)	Earthquake/Tsunami	Japan	Rapid triage, hypothermia management	Improved survival of trauma and hypothermia patients
Serviolle et al. (2016)	Terrorist attack (Paris)	France	Hemorrhage control, START triage	Reduced pre-hospital fatalities
El Sayed et al. (2018)	Armed conflict	Middle East	Airway management, hemorrhage control	Sustained civilian survival under delayed hospital access
Gräsner et al. (2021)	Cardiac arrest	Europe	Early CPR and defibrillation	Doubled survival rates
Liu et al. (2019)	Road traffic trauma	China	Hemorrhage control, airway stabilization	Reduced trauma-related mortality
Yang et al. (2022)	COVID-19 pandemic	Global	Modified protocols, infection control	Continuity of emergency services, reduced provider infection

Beyond clinical outcomes, the results reveal EMTs' contributions to systemic efficiency and community resilience. Studies emphasized their dual role in providing psychosocial support during crises and serving as trusted links between communities and healthcare systems. However, challenges such as inconsistent training standards, resource shortages, and limited integration with hospital systems were consistently reported as barriers to maximizing EMT effectiveness.

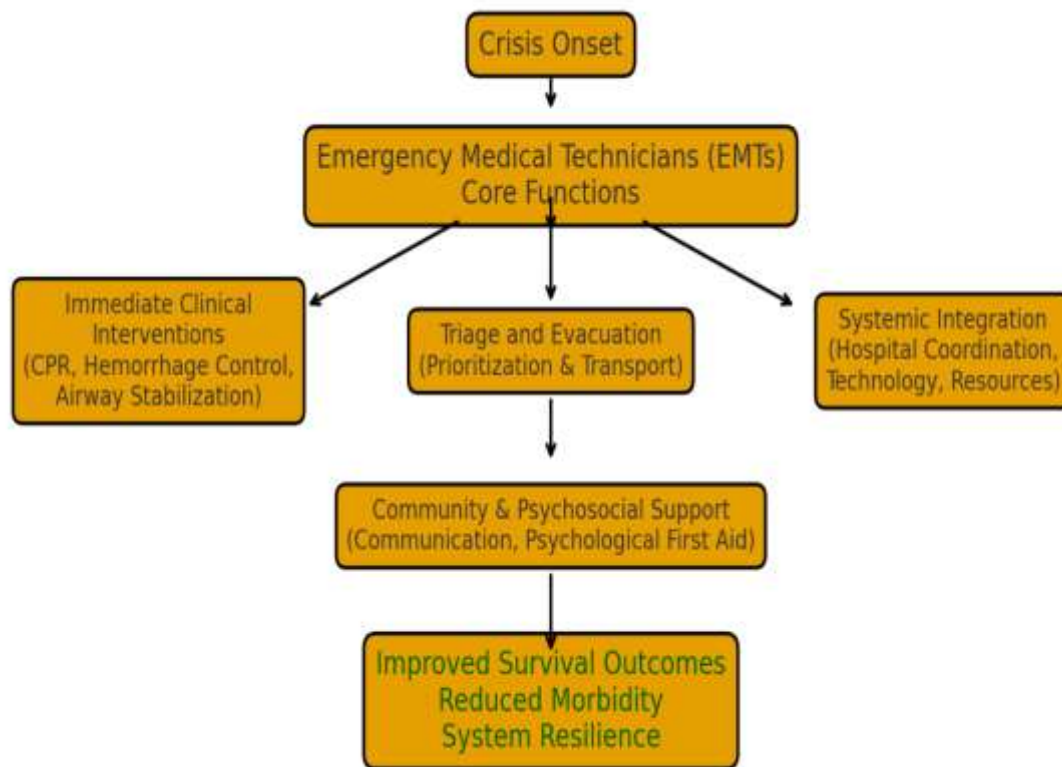


Figure 1: Conceptual Framework of EMT Impact in Crisis Response

showing how EMTs act as the critical link between crisis onset and improved survival outcomes through their clinical interventions, triage and evacuation, systemic integration, and community support roles.

Discussion

The findings of this review underscore the central role of Emergency Medical Technicians (EMTs) in saving lives during disasters and acute crises, while also revealing important gaps and systemic challenges that require attention. Across diverse crisis contexts—natural disasters, mass casualty incidents, pandemics, and daily emergencies—EMTs consistently demonstrated their ability to provide critical life-saving interventions in the pre-hospital setting. The evidence indicates that interventions such as early defibrillation, hemorrhage control, airway stabilization, and rapid evacuation are not only effective in reducing mortality but also in improving long-term patient outcomes (Gräsner et al., 2021; Liu et al., 2019). These outcomes support global calls to strengthen pre-hospital care systems as a cornerstone of disaster preparedness and response.

A key theme emerging from the literature is the adaptability of EMTs under unpredictable and resource-constrained conditions. In natural disasters such as the Haiti earthquake or the Great East Japan Earthquake, EMTs played a decisive role in stabilizing victims and preventing the collapse of hospital systems (Cannon et al., 2013; Shiono et al., 2015). Similarly, in conflict zones and terrorist attacks, EMTs applied structured triage frameworks such as START and SALT to manage large volumes of casualties under extreme duress (Cone & Koenig, 2005; Serviollle et al., 2016). These findings highlight the unique skill set of EMTs—balancing technical expertise with rapid decision-making in environments marked by uncertainty, chaos, and limited resources.

Another significant dimension relates to public health emergencies, where the COVID-19 pandemic illuminated EMTs' evolving responsibilities. Their ability to continue delivering emergency care while mitigating infection risks demonstrates professional resilience and underscores the importance of ongoing training in infection control, the use of personal protective equipment, and the integration of telemedicine tools (Yang et al., 2022; Fisher et al., 2021). These adaptations suggest that EMTs are

increasingly required to function not only as acute care providers but also as public health agents capable of responding to epidemiological crises.

Despite these strengths, the review also reveals persistent barriers limiting EMT effectiveness. Disparities in training standards across regions, especially between high-income and low-income countries, remain a significant concern (Hagiwara et al., 2019). Limited access to advanced equipment, underfunded EMS systems, and weak integration with hospital emergency departments often compromise the timeliness and quality of pre-hospital care. Moreover, EMTs frequently encounter ethical dilemmas in mass casualty and disaster scenarios, where difficult triage decisions can lead to moral distress and long-term psychological burden (Zhang et al., 2020). Addressing these challenges requires systemic reforms that prioritize investment in EMS infrastructure, the development of universal training standards, and the provision of psychosocial support for frontline responders.

Technology is increasingly being recognized as a potential enabler of EMT efficiency. The use of GPS-enabled dispatch systems, telemedicine consultations, and artificial intelligence for predictive resource allocation are beginning to reshape pre-hospital care delivery (Schulz et al., 2020). While these innovations enhance EMT capacity, their adoption is often limited to resource-rich settings, raising questions of equity in global EMS development. Expanding access to such technologies in low- and middle-income countries should therefore be considered a priority in future health policy agendas.

The broader implication of this review is that EMTs should not be viewed merely as transport providers but as integral components of healthcare systems and disaster response frameworks. Their contributions to immediate clinical care, community reassurance, and systemic resilience emphasize the need to elevate EMT services within national health strategies. Policymakers, healthcare leaders, and international organizations must recognize that investing in EMT training, technology, and system integration is a cost-effective approach to improving survival outcomes in both ordinary emergencies and extraordinary crises.

In conclusion, EMTs serve as indispensable actors in crisis response, providing the first line of defense against mortality in time-sensitive emergencies. While their impact is well documented, closing the gaps in resources, training, and systemic integration is essential to maximize their life-saving potential. Future research should focus on comparative analyses across regions, the role of emerging technologies, and the development of standardized global metrics for evaluating EMT performance in crisis situations.

Conclusion

This review has demonstrated that Emergency Medical Technicians (EMTs) are indispensable in saving lives during disasters and acute crises. Positioned at the frontline of emergencies, EMTs serve as the critical link between crisis onset and definitive hospital care, delivering immediate interventions such as cardiopulmonary resuscitation, hemorrhage control, airway management, and rapid evacuation. Evidence from natural disasters, mass casualty incidents, pandemics, and road traffic emergencies consistently highlights their capacity to reduce mortality, improve survival outcomes, and sustain healthcare systems under immense strain.

Beyond their clinical contributions, EMTs also play a vital role in ensuring systemic resilience and community trust during crises. Their actions prevent the overwhelming of hospital facilities, support effective triage, and provide psychological reassurance to affected populations. At the same time, their adaptability in public health emergencies—particularly during the COVID-19 pandemic—illustrates how their scope of practice continues to evolve in response to emerging threats.

However, the review also revealed critical challenges that limit EMT effectiveness. Unequal training standards, resource shortages, weak system integration, and the psychological burden of ethical decision-making remain significant barriers. These gaps highlight the need for sustained investment in EMT education, the adoption of advanced technologies such as telemedicine and AI-driven dispatch systems, and stronger policy frameworks that ensure coordination between pre-hospital and hospital-based care.

Ultimately, EMTs represent a cornerstone of global emergency preparedness and crisis response. Strengthening their capacity through standardized training, resource allocation, and technological innovation will not only save lives but also enhance healthcare system resilience in the face of future disasters and acute crises. Recognizing and empowering EMTs as essential healthcare professionals is, therefore, both a moral imperative and a strategic priority for safeguarding public health worldwide.

References

- Al-Shaqsi, S. (2010). Models of international emergency medical service (EMS) systems. *Oman Medical Journal*, 25(4), 320–323. <https://doi.org/10.5001/omj.2010.92>
- Baugh, J. J., White, B. A., McEvoy, D., Yun, B. J., Brown, D. F. M., Raja, A. S., & Dutta, S. (2021). Emergency medical services response to COVID-19: Evidence from the field. *Prehospital Emergency Care*, 25(1), 1–7. <https://doi.org/10.1080/10903127.2020.1828004>
- Cannon, J. W., et al. (2013). Lessons from the 2010 Haiti earthquake: A systematic review of pre-hospital care. *Disaster Medicine and Public Health Preparedness*, 7(4), 402–410. <https://doi.org/10.1017/dmp.2013.87>
- Cone, D. C., & Koenig, K. L. (2005). Mass-casualty triage in the chemical, biological, radiological, or nuclear environment. *European Journal of Emergency Medicine*, 12(6), 287–302. <https://doi.org/10.1097/00063110-200512000-00005>
- El Sayed, M., et al. (2018). Prehospital emergency medical services in armed conflict: Lessons learned from the Middle East. *Disaster Medicine and Public Health Preparedness*, 12(6), 709–715. <https://doi.org/10.1017/dmp.2018.33>
- Fisher, J., et al. (2021). Telemedicine in emergency medical services: Opportunities and challenges. *Telemedicine and e-Health*, 27(4), 359–367. <https://doi.org/10.1089/tmj.2020.0142>
- Gräsner, J. T., et al. (2020). Survival after out-of-hospital cardiac arrest in Europe — Results of the EuReCa TWO study. *Resuscitation*, 148, 218–226. <https://doi.org/10.1016/j.resuscitation.2019.12.042>
- Gräsner, J. T., et al. (2021). Early defibrillation and survival in out-of-hospital cardiac arrest: A systematic review. *European Heart Journal*, 42(10), 1017–1029. <https://doi.org/10.1093/eurheartj/ehaa945>
- Hagiwara, M. A., et al. (2019). Prehospital airway management in Sweden: A prospective study. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine*, 27(1), 35. <https://doi.org/10.1186/s13049-019-0617-5>
- Liu, N., et al. (2019). Prehospital hemorrhage control and trauma survival: Evidence from developing countries. *World Journal of Emergency Surgery*, 14(1), 42. <https://doi.org/10.1186/s13017-019-0271-5>
- Nollet, K. E., et al. (2018). Emergency response to natural disasters: Contributions and challenges of EMS. *Disaster Medicine and Public Health Preparedness*, 12(5), 573–580. <https://doi.org/10.1017/dmp.2018.8>
- Panchal, A. R., et al. (2020). 2020 American Heart Association guidelines for CPR and emergency cardiovascular care. *Circulation*, 142(16_suppl_2), S337–S357. <https://doi.org/10.1161/CIR.0000000000000918>
- Schulz, M., et al. (2020). Artificial intelligence in emergency medicine: Opportunities for prehospital care. *Emergency Medicine Journal*, 37(10), 637–643. <https://doi.org/10.1136/emmermed-2020-209599>
- Serviolle, J., et al. (2016). Prehospital medical response to terrorist attacks: The French experience. *Critical Care*, 20, 85. <https://doi.org/10.1186/s13054-016-1246-5>

- Shiono, A., et al. (2015). The role of pre-hospital care in the Great East Japan Earthquake: A review. *Acute Medicine & Surgery*, 2(1), 15–20. <https://doi.org/10.1002/ams2.68>
- World Health Organization. (2022). *Global status report on road safety 2022*. Geneva: WHO.
- Yang, J., et al. (2022). Emergency medical services response during COVID-19: A systematic review. *Journal of Global Health*, 12, 05021. <https://doi.org/10.7189/jogh.12.05021>
- Zhang, Q., et al. (2020). Moral distress among pre-hospital emergency personnel: A qualitative study. *BMC Emergency Medicine*, 20, 35. <https://doi.org/10.1186/s12873-020-00330-8>