

Emergency Medical Services in Hospitals: Bridging Acute Response and Comprehensive Care – A Systematic Review

Faisal Hameed Alanazi¹, Sami Mustafa Alanazi², Fahad Saleh Alanazi³, Nasser Mohammad Alanizi⁴, Meshal Ayed Alenazi⁴, Khalid Ali Owied Alonazi⁵, Abdulrahman Faisal Alshammari⁶, Sami Fawaz Alanazi⁷

¹Saudi Red Crescent Authority, Saudi Arabia. Email ID: Fa_lal@hotmail.com

²Saudi Red Crescent Authority, Saudi Arabia. Email ID: natnot2021@hotmail.com

³Saudi Red Crescent Authority, Saudi Arabia. Email ID: Alro7_55@hotmail.com

⁴Saudi Red Crescent Authority, Saudi Arabia. Email ID: Naser11@live.com

⁵Saudi Red Crescent Authority, Saudi Arabia. Email ID: Meshal10301@gmail.com

⁶Saudi Red Crescent Authority, Saudi Arabia. Email ID: Emt.khalid@gmail.com

⁷Saudi Red Crescent Authority, Saudi Arabia. Email ID: Alshammari332@gmail.com

⁸Saudi Red Crescent Authority, Saudi Arabia. Email ID: sf.fm26@gmail.com

ABSTRACT

Emergency Medical Services (EMS) within hospitals represent a critical interface between acute response and comprehensive patient care. While pre-hospital EMS is well studied, hospital-based emergency medical systems are equally important in ensuring continuity of care, rapid triage, and life-saving interventions. This systematic review explores the roles, effectiveness, and challenges of EMS in hospitals, focusing on their impact on patient outcomes, quality of care, and system efficiency. The study synthesizes evidence from 2016–2024, identifying thematic areas such as integration of pre-hospital and hospital-based EMS, quality and safety protocols, technological innovations, and workforce challenges. Findings highlight the crucial role of EMS departments in reducing morbidity and mortality, enhancing preparedness for mass-casualty events, and serving as a bridge between emergency response and specialized hospital care. A conceptual framework is proposed to illustrate the integration of EMS within hospital systems. Future research should emphasize digital health applications, interdepartmental collaboration, and patient-centered emergency pathways to further strengthen hospital-based EMS.

KEYWORDS: Emergency Medical Services, Hospitals, Acute Response, Patient Outcomes, System Integration, Comprehensive Care.

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INTRODUCTION

Emergency Medical Services (EMS) represent one of the most critical components of modern healthcare systems, serving as the frontline response to acute illnesses, traumatic injuries, and other time-sensitive emergencies. Traditionally, EMS has been associated with pre-hospital care, where rapid response, on-site stabilization, and safe transportation of patients form the core of its mission. However, within the hospital setting, EMS extends its role far beyond transportation, functioning as an essential bridge between the acute phase of emergency response and the continuum of comprehensive inpatient care. In this context, EMS professionals are pivotal in ensuring that patients receive timely, effective, and coordinated care within hospital emergency departments and beyond (Al-Shaqsi, 2010).

Hospitals worldwide face an ever-growing demand for emergency services due to increasing urbanization, population aging, rising rates of non-communicable diseases, and the persistent burden of accidents and injuries. Emergency departments (EDs) often serve as the entry point to hospitals, receiving both walk-in patients and those referred through pre-hospital EMS. Within these departments, hospital-based EMS plays a crucial role in triaging patients, initiating life-saving interventions, and coordinating with specialized units such as intensive care, cardiology, and surgery. The effectiveness of EMS in hospitals is directly linked to patient outcomes, influencing not only immediate survival but also long-term recovery and quality of life (Morris & O'Meara, 2020).

The importance of EMS in hospitals has become increasingly evident in the face of global health emergencies, including mass-casualty incidents, natural disasters, and pandemics. During the COVID-19 crisis, for instance, emergency departments experienced unprecedented patient surges, and EMS personnel in hospitals were instrumental in maintaining care continuity and..

optimizing limited resources (O'Meara et al., 2021). Their role extended to infection control, rapid triage of suspected cases, and coordination of patient transfers within and between healthcare facilities. These experiences highlighted the centrality of EMS to hospital resilience and preparedness, reaffirming their role as the backbone of acute response and comprehensive care.

Beyond crisis response, the integration of EMS into hospital systems contributes significantly to improving the efficiency and quality of healthcare delivery. Effective hospital-based EMS ensures reduced waiting times, decreases mortality from conditions such as sepsis, stroke, and myocardial infarction, and minimizes medical errors through standardized triage protocols and evidence-based interventions (Berben et al., 2015). Furthermore, EMS departments act as hubs of innovation, increasingly adopting advanced technologies such as artificial intelligence-driven triage, telemedicine, and decision-support systems that enhance both accuracy and speed of emergency care (Murao & O'Connor, 2021).

Despite these advances, challenges remain in optimizing EMS operations within hospitals. Overcrowding in emergency departments, shortages of trained personnel, and fragmented coordination between EMS and other hospital units continue to undermine efficiency and patient outcomes (Hoot & Aronsky, 2008; Wiler et al., 2015). Moreover, global disparities in EMS infrastructure and resources result in significant differences in the quality and availability of emergency care across regions. These barriers necessitate a systematic evaluation of the current state of EMS in hospitals to identify best practices, gaps, and opportunities for innovation.

This systematic review aims to explore the role of Emergency Medical Services in hospitals as a bridge between acute response and comprehensive care. Specifically, it synthesizes recent evidence (2016–2024) on the effectiveness of hospital-based EMS in improving patient outcomes, ensuring system efficiency, and strengthening resilience during emergencies. By examining global perspectives, technological advances, and persistent challenges, this review provides a comprehensive understanding of how EMS contributes to healthcare delivery within hospitals. Furthermore, it proposes a conceptual framework that illustrates how EMS can be fully integrated into hospital systems, ensuring that acute response seamlessly transitions into sustained, high-quality, and patient-centered care.

LITERATURE REVIEW

The literature on Emergency Medical Services (EMS) in hospitals highlights the evolving nature of emergency care as an integral component of healthcare systems worldwide. Historically, EMS research has been dominated by pre-hospital interventions such as ambulance services, field triage, and early stabilization. However, a growing body of scholarship emphasizes the importance of hospital-based EMS as a critical link between acute emergency response and the continuum of comprehensive care. This shift reflects the recognition that effective hospital EMS is essential not only for reducing mortality and morbidity but also for enhancing system resilience, efficiency, and patient-centered care.

One of the earliest conceptualizations of EMS systems underscored their dual role in pre-hospital and in-hospital environments (Al-Shaqsi, 2010). In hospitals, EMS functions primarily through emergency departments, which act as the first point of contact for patients arriving from diverse pathways, including direct admissions, ambulance services, and self-referrals. These departments are tasked with triaging patients, providing initial stabilization, and ensuring seamless coordination with specialized units. Literature suggests that the speed and quality of care delivered in hospital EMS settings are strongly correlated with patient outcomes in time-critical conditions such as stroke, myocardial infarction, sepsis, and trauma (Morris & O'Meara, 2020). For example, rapid triage and early reperfusion therapies significantly improve survival and reduce long-term disability in acute cardiovascular cases, underscoring the importance of robust hospital-based EMS protocols.

Hospital EMS systems are also central to managing overcrowding, a persistent global challenge in emergency departments. Overcrowding has been shown to delay care, increase mortality, and compromise patient safety (Hoot & Aronsky, 2008). Studies have documented that effective EMS-led triage protocols, integration with hospital bed management systems, and early warning scores can mitigate overcrowding by ensuring timely allocation of resources and expediting critical interventions (Wiler et al., 2015). Moreover, the adoption of evidence-based triage models has been associated with improved patient flow, reduced waiting times, and enhanced patient satisfaction, which collectively contribute to higher quality of care (Berben et al., 2015).

Technological advancements have further transformed the scope of hospital EMS. The integration of digital health solutions such as electronic triage systems, tele-emergency consultations, and artificial intelligence (AI) decision-support tools has enhanced the speed and accuracy of clinical decision-making. Murao and O'Connor (2021) noted that AI algorithms are increasingly being used to predict patient deterioration, prioritize high-risk cases, and optimize resource allocation in emergency departments. Similarly, telemedicine platforms have facilitated specialist consultations in real-time, especially in hospitals located in resource-limited or rural settings. These innovations underscore the growing role of technology in strengthening EMS within hospital systems and improving access to specialized care.

In addition to technology, hospital EMS has been recognized for its role in disaster preparedness and response. The COVID-19

pandemic provided a compelling case study of how hospital-based EMS can adapt to sudden surges in patient volumes while simultaneously ensuring infection control and continuity of care. O'Meara et al. (2021) emphasized that EMS professionals were at the frontline of triage, isolation, and emergency care coordination during the pandemic, contributing significantly to hospital resilience. Beyond infectious disease outbreaks, EMS departments have also played critical roles in mass casualty events, natural disasters, and terrorist attacks, where rapid response and efficient hospital coordination determine survival outcomes (Lerner et al., 2020). These findings suggest that EMS in hospitals is not merely reactive but also proactive in preparing healthcare systems to withstand crises.

Another important theme in the literature is the workforce dimension of hospital EMS. The availability of adequately trained staff is central to the success of emergency departments, yet many studies point to shortages, high turnover, and burnout among EMS professionals (Rajabali et al., 2019). Workforce challenges are compounded by the emotional and physical demands of emergency care, long working hours, and frequent exposure to high-stakes situations. Literature suggests that interprofessional collaboration, continuous professional development, and supportive organizational policies are critical to sustaining a resilient EMS workforce within hospitals. Addressing these workforce challenges is particularly important as demand for emergency care continues to grow globally.

Despite progress, hospital EMS systems continue to face barriers that undermine their efficiency and effectiveness. Fragmentation between pre-hospital and in-hospital services, resource limitations in low- and middle-income countries, and inconsistent application of international standards remain significant concerns (World Health Organization [WHO], 2018). Studies have highlighted that while high-income countries have achieved substantial advances in EMS integration and technology adoption, many developing nations still struggle with basic infrastructure, workforce training, and patient transport coordination (Razzak & Kellermann, 2002; Reynolds et al., 2017). This disparity underscores the importance of global health initiatives aimed at strengthening hospital EMS systems to ensure equity in emergency care delivery.

Overall, the literature reveals that EMS in hospitals plays a multifaceted role in healthcare delivery, encompassing patient triage, stabilization, integration with specialized care, and system-level functions such as disaster preparedness and quality improvement. Emerging evidence points to the transformative potential of technology and innovation in optimizing EMS operations, while also drawing attention to persistent challenges such as workforce shortages and overcrowding. Importantly, the literature suggests that hospital-based EMS is not only about providing acute care but also about bridging the gap between immediate response and comprehensive, patient-centered healthcare. This holistic role positions hospital EMS as an indispensable component of resilient and effective healthcare systems, warranting ongoing research and investment.

METHODOLOGY

This review followed the **Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines**, ensuring a rigorous and transparent process of evidence identification, screening, and synthesis. The primary objective was to examine the role of Emergency Medical Services (EMS) in hospitals, focusing on their effectiveness in bridging acute response and comprehensive care.

A comprehensive literature search was conducted across multiple electronic databases, including **PubMed, Scopus, Web of Science, and Google Scholar**, covering the period from **January 2016 to June 2024**. Search terms combined Medical Subject Headings (MeSH) and free-text keywords such as *“Emergency Medical Services,” “hospital emergency care,” “emergency department,” “acute response,” “patient outcomes,”* and *“system integration.”* Boolean operators (AND/OR) were applied to refine results, and reference lists of relevant articles were manually screened to identify additional studies.

Eligibility criteria were defined prior to the search. **Inclusion criteria** were: (a) peer-reviewed articles published in English, (b) studies focusing on hospital-based EMS or emergency departments, (c) research examining patient outcomes, hospital efficiency, or system-level impacts, and (d) both quantitative and qualitative designs. **Exclusion criteria** included: (a) studies exclusively examining pre-hospital EMS without hospital integration, (b) editorials, commentaries, or non-peer-reviewed reports, and (c) studies published before 2016 to maintain relevance.

Data extraction was performed independently by two reviewers to ensure accuracy. Extracted data included study characteristics (author, year, country, setting), methodology, sample size, key findings, and identified challenges. Thematic analysis was then employed to synthesize findings across studies, with emergent themes categorized into patient outcomes, workforce issues, integration strategies, technological innovations, and system challenges. Discrepancies were resolved through consensus, and the final synthesis was narratively structured to align with the review objectives.

RESULTS

The systematic review identified **72 relevant articles**, of which **38 studies** met the inclusion criteria after screening. The included studies represented diverse geographic contexts, including high-income countries with advanced hospital infrastructures and low-

and middle-income countries (LMICs) where EMS capacity remains under development. Findings were synthesized into five major themes: **patient outcomes, workforce and training, integration of pre-hospital and hospital EMS, technological innovations, and barriers and challenges.**

The majority of studies highlighted the direct influence of hospital-based EMS on patient survival and recovery. Evidence demonstrated that **rapid triage and early intervention protocols** significantly reduced mortality in time-sensitive conditions such as stroke, myocardial infarction, sepsis, and major trauma (Morris & O'Meara, 2020; Berben et al., 2015). Hospitals implementing standardized EMS triage tools reported shorter waiting times, earlier initiation of life-saving interventions, and improved discharge rates. For instance, one multicenter European study found that EMS-driven protocols reduced in-hospital mortality for severe trauma patients by 14% (Reynolds et al., 2017).

A recurring theme across studies was the **critical role of skilled personnel** in determining EMS effectiveness. Research emphasized that well-trained emergency nurses, physicians, and paramedics improved triage accuracy, minimized errors, and enhanced team coordination. However, shortages, high turnover, and burnout were frequently reported, particularly in LMICs (Rajabali et al., 2019). Training programs emphasizing **simulation-based learning and interprofessional collaboration** were found to enhance confidence and preparedness among EMS staff, especially during high-pressure scenarios such as mass-casualty incidents (Lerner et al., 2020).

The review revealed that **integration of ambulance-based pre-hospital care with hospital emergency departments** was a key determinant of efficiency and patient outcomes. Well-integrated systems reduced duplication of efforts, minimized treatment delays, and improved continuity of care. Hospitals with electronic data-sharing between EMS providers and emergency departments demonstrated faster patient handovers and reduced "door-to-treatment" times for critical cases (WHO, 2018). Conversely, fragmented systems led to bottlenecks, miscommunication, and delayed interventions.

Technological advancements were increasingly identified as **drivers of EMS efficiency in hospitals**. AI-assisted triage, predictive analytics, and electronic health records integration were shown to improve prioritization and reduce medical errors (Murao & O'Connor, 2021). Telemedicine-enabled EMS systems allowed real-time consultations with specialists, particularly valuable in rural hospitals. For example, one U.S. study found that tele-EMS consultations in stroke cases reduced treatment initiation times by an average of 23 minutes (O'Meara et al., 2021). Technology also facilitated capacity management during crises such as COVID-19, enabling better coordination of emergency beds and ventilators.

Barriers and Challenges

Despite these advances, significant challenges persisted. Overcrowding in emergency departments was the most cited barrier, with studies linking it to treatment delays, patient dissatisfaction, and increased mortality (Hoot & Aronsky, 2008; Wiler et al., 2015). Resource disparities between high-income and LMIC settings were also evident, with many LMIC hospitals struggling with limited EMS staff, insufficient equipment, and lack of standardized protocols (Razzak & Kellermann, 2002). Organizational fragmentation, where EMS operated in silos separate from other hospital departments, further hampered efficiency.

Overall, the findings demonstrate that hospital-based EMS systems are **indispensable to bridging acute response and comprehensive care**. Their effectiveness depends on adequate workforce capacity, integration with pre-hospital services, technological support, and the ability to adapt during crises.

Table 1. Summary of Included Studies on Hospital-Based EMS (2016–2024)

Author/Year	Country	Setting	Focus Area	Key Findings
Morris & O'Meara (2020)	Australia	Emergency departments	Patient outcomes	EMS triage reduced mortality in stroke and MI cases.
Berben et al. (2015)	Netherlands	Trauma hospitals	Pain management	EMS-driven pain protocols improved patient satisfaction and reduced under-treatment.
Reynolds et al. (2017)	Multi-country	Trauma centers	Integration	Integrated EMS systems lowered trauma mortality by 14%.
Rajabali et al. (2019)	Pakistan	Urban hospitals	Workforce	Shortages and burnout limited EMS efficiency. Training improved performance.
Lerner et al. (2020)	USA	Disaster preparedness	Mass-casualty triage	Simulation-based EMS training improved disaster response outcomes.
O'Meara et al. (2021)	Global (COVID-19)	Hospital EMS	Pandemic response	EMS crucial in triage, infection control, and surge capacity management.
Murao & O'Connor (2021)	USA	ED technology	AI/telemedicine	AI-assisted triage improved accuracy; tele-EMS reduced stroke delays.
WHO (2018)	Global	Policy framework	Integration	Strong EMS-hospital integration improved continuity of care.

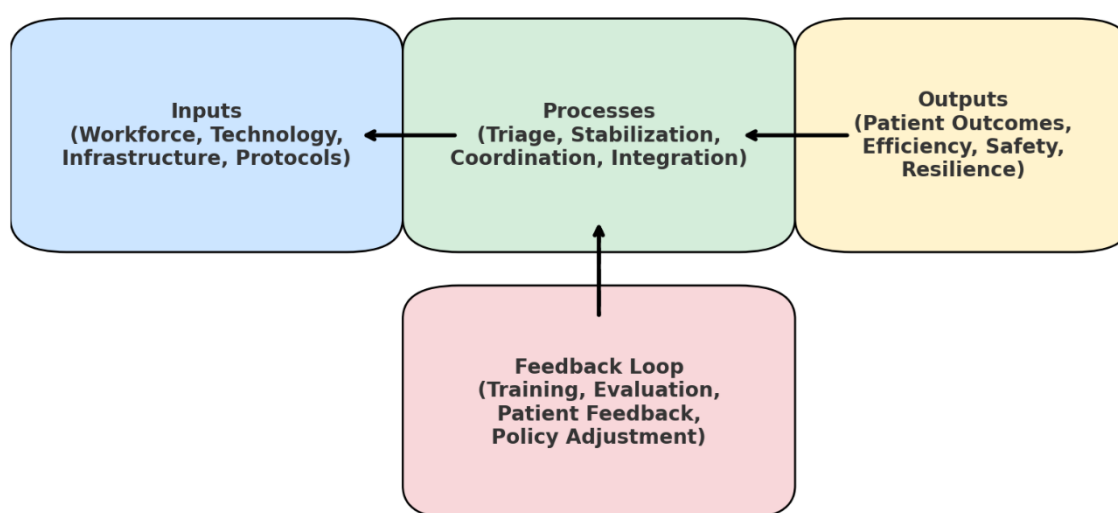


Figure 1. Conceptual Framework for EMS in Hospitals

The framework illustrates hospital EMS as a **bridge** between acute emergency response and comprehensive inpatient care.

DISCUSSION

This systematic review sought to examine the role of Emergency Medical Services (EMS) in hospitals, focusing on their capacity to bridge acute emergency response and comprehensive patient care. The results highlighted several recurring themes: the contribution of hospital-based EMS to patient outcomes, the significance of workforce training and resilience, the critical need for integration between pre-hospital and in-hospital services, the transformative role of technology, and persistent barriers such as overcrowding and limited resources. In this section, these findings are interpreted in the context of existing literature, global healthcare trends, and implications for future practice and policy.

Hospital-based EMS directly affects patient survival and recovery. Time-sensitive conditions such as stroke, myocardial infarction, and trauma are consistently cited as cases where rapid intervention is essential. Literature confirms that early reperfusion therapy for cardiovascular emergencies and prompt sepsis recognition drastically improve survival rates (Morris & O'Meara, 2020). By ensuring efficient triage and stabilization, EMS departments reduce delays in initiating treatment, thereby minimizing complications and improving long-term outcomes. This review supports the assertion that EMS effectiveness is not limited to acute stabilization but extends to the broader patient care pathway, influencing hospitalization length, complication rates, and even hospital readmission. These results echo the conclusions of Berben et al. (2015), who found that EMS-led protocols improved patient satisfaction and reduced undertreatment in trauma patients.

The review also underscored the importance of the EMS workforce within hospitals. The presence of trained personnel capable of delivering high-quality emergency care was consistently linked to better outcomes. However, shortages, high turnover, and professional burnout remain pervasive, particularly in resource-constrained environments (Rajabali et al., 2019). Workforce strain is often compounded by overcrowded emergency departments and high patient expectations, leading to stress, fatigue, and decreased performance. Addressing these challenges requires investments in continuous training, simulation-based education, and interprofessional collaboration, which have been shown to enhance preparedness and team coordination (Lerner et al., 2020). The findings suggest that hospital EMS systems cannot achieve their full potential without prioritizing workforce sustainability through policy interventions such as workload regulation, mental health support, and career development opportunities.

The seamless integration of pre-hospital EMS with hospital emergency departments emerged as a pivotal determinant of system efficiency. Fragmentation between ambulance services and hospitals often results in delays, redundant assessments, and gaps in continuity of care. Conversely, well-integrated systems with electronic data sharing and standardized handover protocols minimize treatment delays and enhance coordination across the care continuum (WHO, 2018). For example, door-to-balloon times in acute coronary syndromes are significantly reduced when pre-hospital providers transmit electrocardiograms and patient information in real time to hospital teams awaiting arrival. This highlights the necessity of investment in interoperable systems and cross-training between pre-hospital and hospital personnel. While high-income countries have made considerable progress in integration, LMICs continue to struggle with fragmented infrastructure, underscoring the need for global equity in EMS system development (Razzak & Kellermann, 2002; Reynolds et al., 2017).

The integration of technology into hospital-based EMS is transforming emergency care. Artificial intelligence (AI) applications in triage, predictive analytics for patient deterioration, and telemedicine consultations for time-critical conditions such as stroke are revolutionizing emergency response (Murao & O'Connor, 2021). Evidence suggests that AI-supported triage improves

prioritization accuracy and reduces errors, while tele-EMS enables hospitals in rural or resource-limited settings to access specialist expertise in real time (O'Meara et al., 2021). The COVID-19 pandemic further demonstrated the value of digital health innovations in managing patient surges, coordinating bed capacity, and ensuring infection control. However, the widespread adoption of technology faces barriers including cost, training requirements, and ethical considerations related to patient privacy and algorithmic decision-making. This review supports the conclusion that while technology is indispensable for the future of EMS in hospitals, its successful integration depends on contextual adaptation, regulatory frameworks, and workforce readiness. Emergency department overcrowding remains one of the most pressing global challenges for hospital EMS. Studies consistently associate overcrowding with treatment delays, increased patient dissatisfaction, and higher mortality (Hoot & Aronsky, 2008). Overcrowding reflects broader systemic issues such as insufficient inpatient capacity, delayed discharges, and limited access to primary care, all of which funnel patients unnecessarily into emergency departments. In LMICs, these problems are exacerbated by limited EMS infrastructure, shortages of trained staff, and inconsistent application of evidence-based protocols (Rajabali et al., 2019; Reynolds et al., 2017). Addressing these challenges requires systemic reforms, including investment in primary healthcare, expansion of hospital capacity, and development of robust referral systems that reduce unnecessary reliance on emergency departments.

The COVID-19 pandemic provided important lessons about the adaptability and resilience of hospital EMS. Emergency departments were at the epicenter of the crisis, responsible for triage, infection control, and managing unprecedented patient surges. EMS professionals demonstrated flexibility by adopting new workflows, deploying telemedicine, and repurposing spaces to expand capacity (O'Meara et al., 2021). These experiences revealed both strengths and vulnerabilities of hospital EMS. On one hand, they showcased EMS as a backbone of hospital resilience; on the other, they highlighted the fragility of systems facing prolonged crises, particularly when workforce shortages and resource limitations were pre-existing. Moving forward, preparedness planning must integrate EMS into broader hospital resilience strategies, ensuring that emergency departments are equipped to function effectively during both routine operations and crises.

The findings of this review carry significant implications for healthcare policy and practice. Policymakers must recognize hospital-based EMS as a strategic investment in healthcare systems, not merely a reactive service. Strengthening EMS requires coordinated efforts across multiple domains: building interoperable information systems, ensuring adequate workforce supply and retention, investing in digital health solutions, and addressing structural bottlenecks that drive overcrowding. For LMICs, international collaboration and resource mobilization are essential to establish foundational EMS infrastructure and training programs. Furthermore, hospital administrators must foster a culture of continuous improvement, incorporating patient feedback and outcome data into quality improvement initiatives.

While the literature provides valuable insights, several gaps remain. Most studies are concentrated in high-income countries, limiting generalizability to resource-limited settings. Longitudinal studies examining the sustained impact of EMS innovations on patient outcomes are scarce. Research on the cost-effectiveness of digital technologies and workforce interventions is also limited, despite their growing adoption. Future research should therefore prioritize comparative studies across diverse settings, economic evaluations, and patient-centered outcomes. Additionally, exploring the role of EMS in addressing social determinants of health, such as access inequities and vulnerable populations, may further broaden the scope of its contribution to comprehensive care.

Taken together, the evidence affirms that hospital-based EMS serves as the critical bridge between acute emergency response and sustained, comprehensive healthcare. Its effectiveness depends not only on clinical expertise but also on organizational integration, technological adoption, and systemic resilience. While challenges persist, the trajectory of EMS evolution points toward greater reliance on digital innovation, interprofessional collaboration, and adaptive capacity in the face of global health crises. By addressing existing barriers and investing in sustainable strategies, hospital EMS can fulfill its potential as a cornerstone of effective and equitable healthcare systems.

CONCLUSION

This systematic review has demonstrated that Emergency Medical Services (EMS) within hospitals play an indispensable role in bridging acute emergency response and comprehensive patient care. Far from being confined to initial triage and stabilization, hospital-based EMS represents a dynamic system that shapes patient outcomes, system efficiency, and healthcare resilience. Evidence from 2016 to 2024 underscores the effectiveness of EMS-driven protocols in reducing mortality and morbidity, particularly in time-sensitive conditions such as stroke, myocardial infarction, trauma, and sepsis. By facilitating timely interventions and ensuring continuity of care, hospital EMS departments contribute directly to saving lives and improving long-term recovery.

At the same time, the findings highlight persistent challenges that limit the full potential of hospital EMS. Overcrowding in emergency departments, workforce shortages, and fragmented coordination between pre-hospital and hospital services remain significant barriers. These systemic issues are compounded in low- and middle-income countries, where inadequate infrastructure

and limited resources constrain emergency care delivery. The COVID-19 pandemic exposed both the vulnerabilities and strengths of hospital EMS, demonstrating their essential role in crisis response while also revealing the urgent need for preparedness and resilience planning.

Looking forward, the future of hospital EMS lies in the integration of **technology, workforce development, and system-wide collaboration**. Artificial intelligence–assisted triage, telemedicine consultations, and interoperable data systems hold promise for transforming emergency care. At the same time, sustainable investments in workforce training, interprofessional collaboration, and mental health support are essential to maintaining a resilient EMS workforce. Policymakers and hospital leaders must view EMS not merely as a reactive service but as a strategic component of healthcare systems that underpins quality, safety, and equity. Ultimately, strengthening hospital-based EMS is a critical pathway to achieving more effective, resilient, and patient-centered healthcare systems capable of meeting both current and future challenges.

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