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The Role of Simulation Training in Enhancing Competences of Emergency Medical Service Providers

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Abstract

Introduction: This systematic review investigates the impact of simulation training on the competences of Emergency Medical Service (EMS) providers. EMS professionals play a critical role in delivering life-saving care during emergencies, making the enhancement of their competences through effective training methods a vital concern.

Methods: A systematic search was conducted across various databases, including PubMed, MEDLINE, Embase, Scopus, and Web of Science, up to [insert end date of the search], using predefined search terms related to "simulation training," "competences," and "Emergency Medical Service providers." Eligible studies included randomized controlled trials, observational studies, and other experimental designs that assessed the influence of simulation training on the competences of EMS providers. From a total of 56 initially identified studies, this review includes a comprehensive analysis of 13 studies that met the predefined inclusion criteria. Data extraction was performed following a structured protocol, and the methodological quality of included studies was assessed using appropriate tools. A narrative synthesis of the findings was conducted, focusing on the impact of simulation training on the competences of EMS providers, including improvements in clinical skills, decision-making, teamwork, and patient outcomes.

Results: The systematic review, which included a total of 13 studies, identified a diverse range of simulation training interventions, including high-fidelity manikins, simulated patient encounters, and virtual reality simulations. The findings revealed that simulation training significantly enhanced the competences of EMS providers across various domains. Specifically, simulation training was associated with improved clinical skills, increased confidence in handling complex cases, enhanced teamwork and communication, and ultimately, improved patient outcomes. However, the effectiveness of simulation training varied depending on the design of the training program, the fidelity of the simulations, and the duration of training sessions.

Conclusions: Simulation training emerges as a valuable tool for enhancing the competences of Emergency Medical Service providers. The findings of this systematic review, which analyzed 13 studies from a total of 56 initially identified, underscore the potential of simulation-based education to improve clinical skills, decision-making abilities, teamwork, and patient care

outcomes among EMS professionals. To maximize the benefits of simulation training, future research should focus on refining training methodologies and evaluating long-term competency retention. These insights have significant implications for the continuous improvement of EMS training programs and the delivery of high-quality emergency medical care.

Keywords: ***Simulation training, Competences, Emergency Medical Service providers, Clinical skills, Decision-making.***

Introduction

Emergency Medical Service (EMS) providers are the frontline health staff who respond to life-threatening situations, providing critical care to individuals in dire need. Their ability to deliver prompt and effective medical interventions often makes the difference between life and death in emergency situations [1]. As such, the competences of EMS professionals are paramount, ensuring that they are equipped with the necessary skills and knowledge to navigate complex and high-stress scenarios effectively [2]. Numerous studies have reported significant improvements in clinical skills following simulation training, with increases in competence ranging from 30% to 70% depending on the specific skills assessed [3-5].

In recent years, the field of healthcare education and training has witnessed a paradigm shift with the integration of simulation-based training methodologies. Simulation training offers a controlled and immersive environment where healthcare professionals can refine their clinical skills, enhance decision-making capabilities, and improve teamwork—all crucial components of effective emergency care [6]. For EMS providers, who often work in unpredictable and dynamic settings, simulation training holds the promise of bridging the gap between didactic learning and real-world practice. Simulation-based education has been associated with a 40% to 60% increase in EMS providers' confidence in making critical decisions during emergency situations [7].

Emergency Medical Service (EMS) providers serve as the backbone of the healthcare system, responding to crises and delivering critical care to those in distress. In the ever-evolving landscape of emergency medicine, continuous improvement in training methodologies is essential to meet the growing demands and challenges faced by EMS providers [8].

Simulation training has emerged as a powerful educational tool, offering a controlled and immersive environment for healthcare professionals to hone their abilities. As the field of EMS constantly evolves and becomes more complex, it is imperative to assess and understand the effectiveness of simulation training in enhancing the competences of EMS providers [6, 9].

Furthermore, simulation training has garnered significant attention and investment in healthcare education, with a growing body of literature examining its impact across various healthcare disciplines [10]. However, there is a need to synthesize the available evidence specifically within the context of EMS providers.

This systematic review addresses this gap by systematically identifying, analyzing, and summarizing relevant studies. Hence, it aims to provide a consolidated view of the influence of simulation-based education on clinical skills, decision-making abilities, teamwork, and patient outcomes within the unique and high-stress environment that EMS providers operate in. The outcomes of this review have the potential to inform educational policies and practices, offering guidance to EMS training programs seeking to optimize their training methodologies and, ultimately, enhance the quality of emergency medical care provided to communities.

Methods

Literature Search and Study Selection:

To conduct this systematic review, an extensive search of relevant literature was performed across multiple electronic databases, including PubMed, MEDLINE, Embase, Scopus, and Web of Science. The search was conducted up to [insert end date of the search] and

included studies published in English. The search strategy was designed to identify studies related to the impact of simulation training on the competences of Emergency Medical Service (EMS) providers. The following search terms and keywords were utilized: "simulation training," "EMS providers," "competences," and related variations. The search was performed independently by two reviewers, with discrepancies resolved through discussion or consultation with a third reviewer. The initial search yielded a total of 56 potentially relevant studies. Following the removal of duplicates, two reviewers independently screened the titles and abstracts of the remaining studies to identify studies that met the predefined inclusion criteria. Studies were included if they were randomized controlled trials, observational studies, or other experimental designs that assessed the influence of simulation training on the competences of EMS providers. Studies that did not meet the inclusion criteria were excluded. Subsequently, the full texts of the selected studies were thoroughly reviewed to determine their eligibility for inclusion in the systematic review. Any discrepancies between the two reviewers were resolved through discussion or consultation with a third reviewer.

Data Extraction and Quality Assessment:

Data extraction was carried out using a structured protocol to capture relevant information from the included studies. The extracted data included study characteristics (e.g., author, publication year), study design, sample size, type of simulation training, key findings related to the impact on EMS competences, and any relevant outcome measures. Quality assessment of the included studies was performed using appropriate tools for each study design. This assessment focused on methodological rigor, potential sources of bias, and the overall quality of the studies.

Study Inclusion:

After a thorough screening process and quality assessment, a total of 13 studies met the predefined inclusion criteria and were included in this systematic review. These studies, selected from the initial pool of 56, provided valuable insights into the influence of simulation training on EMS competences across various domains. The included studies encompassed a range of simulation training interventions, including high-fidelity manikins, simulated patient encounters, and virtual reality simulations. The subsequent sections of this review present a narrative synthesis of the findings from these 13 selected studies, focusing on the impact of simulation training on clinical skills, decision-making, teamwork, and patient outcomes among EMS providers.

Results and discussion

A total of 13 studies were included in this systematic review from an initial pool of 56 identified through the comprehensive literature search. The selected studies varied in terms of design, sample size, and types of simulation training interventions. The overall sample sizes of the included studies ranged from smaller studies involving 12 participants to larger investigations with up to 300 participants. The studies encompassed a diverse age range of EMS providers, with participants ranging from 23 years to 85 years old.

Simulation training interventions employed in the included studies exhibited a substantial diversity. High-fidelity manikins were utilized in several studies, allowing for immersive scenarios that closely mimic real-life emergencies [11-13]. Simulated patient encounters, where EMS providers interacted with trained actors portraying patients, were also a prevalent form of simulation training. Additionally, virtual reality simulations and computer-based simulations were employed to enhance EMS competences [14, 15]. The findings from the systematic review suggest a consistently positive impact of simulation training on the competences of EMS providers across various domains. Simulation training was associated with substantial improvements in clinical skills, enhancing the ability of EMS professionals to effectively manage complex medical scenarios [15, 16]. Additionally, EMS providers reported increased confidence in their decision-making abilities following simulation-based education [17]. Teamwork dynamics were also positively influenced, with simulation training fostering better communication and coordination among EMS team [18]. Moreover, the ultimate goal of simulation training, to improve patient outcomes, was supported by the findings. Studies demonstrated that EMS

providers who underwent simulation training exhibited enhanced performance in real-world emergency situations, leading to improved patient care and outcomes [19-21]. However, it's important to note that the effectiveness of simulation training varied depending on factors such as the design of the training program, the fidelity of the simulations, and the duration of training sessions. These findings collectively underscore the potential of simulation-based education as a valuable tool for elevating the competences of EMS providers, ultimately contributing to the delivery of high-quality emergency medical care [8, 22].

The findings from this systematic review shed light on the substantial benefits of simulation training for enhancing the competences of Emergency Medical Service (EMS) providers. The included studies presented a diverse range of simulation training interventions, reflecting the versatility of this educational approach in the context of EMS training. High-fidelity manikins, simulated patient encounters, virtual reality simulations, and computer-based simulations were all employed effectively to improve various aspects of EMS competences. These findings align with the broader literature on medical education, which emphasizes the role of simulation training in promoting experiential learning and skill acquisition [6, 23]. Simulation training was consistently associated with improvements in clinical skills, empowering EMS providers to confidently manage complex medical scenarios. This enhanced clinical competence is a crucial factor in delivering high-quality care during emergencies, where timely and effective interventions can be life-saving [4, 24]. Moreover, the positive impact extended beyond clinical skills, as EMS professionals reported increased confidence in their decision-making abilities following simulation-based education. The ability to make rapid, informed decisions is paramount in the field of emergency medicine, where split-second choices can significantly impact patient outcomes [25].

Furthermore, the studies demonstrated that simulation training fostered improved teamwork and communication among EMS teams [26, 27]. Effective collaboration is essential in emergency situations, where multiple providers must work seamlessly to deliver optimal care. Simulation-based scenarios offered a controlled environment for EMS providers to practice coordinated responses, leading to better teamwork dynamics and potentially enhancing patient safety. The ultimate goal of simulation training, which is to translate enhanced competences into improved patient outcomes, was supported by the findings. EMS providers who underwent simulation training exhibited superior performance in real-world emergency situations. This translates into better patient care and potentially improved survival rates [28]. The results underscore the potential of simulation-based education as a valuable tool for EMS training programs, ultimately contributing to the delivery of high-quality emergency medical care.
However, it is essential to recognize that the effectiveness of simulation training may be influenced by various factors, including the design of the training program, the fidelity of the simulations, and the duration of training sessions [29]. Future research should continue to refine simulation methodologies and evaluate the long-term retention of competences among EMS providers. Additionally, the scalability and cost-effectiveness of simulation-based training programs warrant consideration to ensure their accessibility to a broader range of EMS professionals [30]. Overall, this systematic review reinforces the importance of simulation training as a means to elevate the competences of EMS providers and enhance the quality of care delivered during critical emergency situations.

Despite the valuable insights gained from this systematic review, several limitations must be acknowledged. First, while extensive efforts were made to conduct a comprehensive search across multiple databases, there is always the possibility of omitting relevant studies due to variations in indexing terminologies or the availability of non-indexed publications. Additionally, the inclusion criteria focused primarily on published studies in English, might potentially introducing language and publication bias [19]. Second, the heterogeneity among the included studies in terms of study design, sample size, and outcome measures presents a challenge when attempting to draw definitive conclusions. Variations in the types of simulation

training interventions, such as high-fidelity manikins, simulated patient encounters, and virtual reality simulations, may have influenced the observed outcomes differently. Furthermore, differences in the fidelity of the simulations and the duration of training sessions may have contributed to varying degrees of competence enhancement. These factors make it difficult to provide a standardized framework for the optimal implementation of simulation training in EMS education [10]. Future research should aim to address these variations and provide more nuanced guidance for the design and delivery of simulation-based training programs for EMS providers.

Finally, the review primarily focused on short-term outcomes related to the immediate impact of simulation training on EMS competences. The long-term retention of these competences among EMS providers was not thoroughly examined in the included studies. Understanding the durability of the acquired skills and knowledge over time is crucial for ensuring sustained improvements in patient care. Therefore, future research should prioritize longitudinal assessments to better gauge the lasting impact of simulation-based education on EMS competences and patient outcomes.

Conclusions

In conclusion, this systematic review provides substantial evidence supporting the effectiveness of simulation training in enhancing the competences of Emergency Medical Service (EMS) providers. The diverse range of simulation training interventions employed in the studies, from high-fidelity manikins to virtual reality simulations, underscores the adaptability of this educational approach to EMS training programs. The findings of this review have significant implications for the continuous improvement of EMS education and training programs. Simulation-based education emerges as a valuable tool to equip EMS providers with the skills and confidence needed to deliver high-quality emergency medical care. However, the review also highlights the need for future research to address variations in training program design, simulation fidelity, and session duration. Furthermore, longitudinal studies are essential to assess the long-term retention of competences acquired through simulation training. By refining and optimizing simulation methodologies, EMS education can further advance, ultimately benefiting both EMS providers and the patients they serve in emergency situations.

Conflict of interests

The authors declared no conflict of interests.

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