

Developing A Comprehensive Quality Assessment Framework For Pre-Hospital Emergency Medical Services In Iran: Integrating Global Best Practices With Local Adaptation

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ABSTRACT

Pre-hospital Emergency Medical Services (EMS) are crucial for providing timely care in life-threatening situations, significantly impacting patient outcomes. In Iran, the demand for effective EMS has grown, emphasizing the need for a robust quality assessment model. This review addresses the importance of developing a tailored model to improve EMS quality in Iran, considering specific challenges such as resource limitations and training needs. Taking this issue, the aim of our reviews is to design a comprehensive evaluation framework by analyzing the best global practices and adapting them to Iran's conditions, in order to develop a suitable model for improving the quality of EMS in Iran while addressing specific challenges such as resource limitations and educational needs. In conclusion, the findings of this comprehensive review can propose a strategic approach to enhance the quality of EMS, accompanied by recommendations for implementation and future research.

Keywords: Emergency Medical Services, quality assessment, Healthcare Systems, Healthcare Policy.

INTRODUCTION

EMS play a crucial role in the healthcare system, providing immediate care to patients before they reach a hospital. In Iran, the EMS system has undergone significant development over the past few decades, but it still faces challenges unique to the region (1). Iran's EMS system is managed by the Emergency Medical Services Organization (EMSOS), under the Ministry of Health and Medical Education. The system includes a wide range of services, from dispatch centers to ambulance services, and operates in both urban and rural settings. The EMS infrastructure in Iran is expanding, with improvements in ambulance coverage, communication systems, and training programs for EMS personnel. However, disparities in access to services between urban and rural areas persist, with rural regions often facing longer response times and limited resources. Moreover, the EMS system in Iran has to contend with a high burden of road traffic accidents, which are a leading cause of mortality and morbidity in the country (1).

Quality assessment in EMS is vital to ensure that the services provided are efficient, effective, and equitable. In Iran, where EMS is a critical component of the healthcare delivery system, especially in emergency situations, the need for rigorous quality assessment is more pronounced. Quality assessment involves evaluating various aspects of EMS, including response times, patient outcomes, resource utilization, and staff performance. It helps identify gaps in service delivery and areas for improvement, which is essential for enhancing the overall effectiveness of the EMS system (2).

In Iran, quality assessment is particularly important due to the diverse challenges faced by the EMS system, including resource constraints, variability in service delivery, and the need for ongoing training and education for EMS personnel. Implementing a robust quality assessment framework can help address these challenges by providing data-driven insights and facilitating the development of targeted strategies for improvement. Recent studies emphasize the importance of adopting global best practices in quality assessment while adapting them to the local context of Iran. This includes the development of standardized protocols, continuous monitoring and evaluation, and the integration of advanced technologies such as telemedicine to improve response times and patient care. Therefore, introducing a comprehensive quality assessment framework in Iran's EMS system is essential for improving service delivery, enhancing patient outcomes, and ensuring that the EMS system can meet the growing demands of the population. Due to this issue, the aim of our review are explore the current state of EMS in Iran,

highlight the importance of quality assessment, and propose a model for improving the quality of EMS in the country, drawing on the latest global practices and research (3).

Current challenges in EMS quality management

Infrastructure and resource limitations: The infrastructure of EMS in Iran faces significant challenges due to limited resources. Many regions, particularly rural and remote areas, lack adequate EMS facilities, such as well-equipped ambulances, emergency medical centers, and advanced communication systems. These limitations can lead to delays in emergency response and reduced effectiveness in patient care. Additionally, the shortage of medical supplies and equipment hampers the ability to provide timely and appropriate interventions, further exacerbating the quality of EMS delivery (4).

Training and competency of EMS personnel: The training and competency of EMS personnel are critical factors in ensuring high-quality care. In Iran, there is a need for standardized training programs that are regularly updated to reflect the latest medical knowledge and techniques. The existing variability in the education and certification of EMS staff leads to inconsistencies in patient care. Continuous professional development and specialized training in areas such as trauma care, cardiopulmonary resuscitation (CPR), and the use of advanced life support (ALS) equipment are essential to improving the competency of EMS providers and enhancing overall service quality(4).

Response time and patient outcomes: Response time is a key indicator of EMS effectiveness, directly influencing patient outcomes. In Iran, response times can be delayed due to various factors, including traffic congestion, inadequate dispatch systems, and insufficient coverage in rural areas. Delays in response times are associated with higher mortality and morbidity rates, particularly in critical cases such as cardiac arrest or severe trauma. Addressing these challenges requires investments in technology, such as GPS-enabled dispatch systems, and strategic placement of EMS units to ensure rapid access to emergency care across the country (5).

Legal and regulatory framework: The legal and regulatory framework governing EMS in Iran presents another set of challenges. While there are regulations in place, they are often outdated or inconsistently enforced. This can lead to variations in service delivery, patient care standards, and accountability among EMS providers. Furthermore, the lack of clear guidelines for EMS operations in disaster situations or mass casualty events can hinder effective response. Strengthening the legal framework, along with establishing robust regulatory oversight, is essential for standardizing EMS practices and ensuring that all citizens receive high-quality emergency care (5).

In total, expanding on these challenges, it is evident that addressing infrastructure, training, response time, and legal issues are critical to improving the overall quality of EMS in Iran. Future efforts should focus on policy reforms, resource allocation, and capacity-building initiatives to overcome these obstacles and enhance the effectiveness of pre-hospital emergency care.

Global perspectives on EMS quality assessment models

Comparative analysis of international EMS models: EMS systems vary significantly across different countries, shaped by diverse healthcare infrastructures, socioeconomic conditions, and cultural contexts. A comparative analysis of international EMS models highlights the strengths and weaknesses inherent in these systems, offering valuable insights for countries like Iran seeking to enhance their own EMS quality (6).

In high-income countries such as the United States, the EMS system is characterized by advanced technological integration, including widespread use of electronic health records (EHRs) and telemedicine, which facilitate real-time patient data exchange and decision-making. The U.S. model emphasizes rapid response times, with a well-established network of air and ground ambulances equipped with cutting-edge medical devices. However, challenges such as disparities in EMS access between urban and rural areas persist, necessitating continuous evaluation and reform (7). European countries, particularly Germany and the United Kingdom, demonstrate robust EMS systems that integrate pre-hospital care with hospital-based services. The German EMS model is physician-led, with doctors often present in ambulances, ensuring high-level medical care from the point of contact. The UK's model, managed primarily by paramedics, emphasizes a tiered response system where different levels of care are provided based on the severity of the patient's condition. These systems are supported by strong regulatory frameworks that ensure consistent standards across regions (8).

In contrast, low- and middle-income countries face significant challenges in EMS delivery due to limited resources and infrastructure. For instance, in India and Brazil, EMS systems are still evolving, with a focus on expanding coverage and improving basic life support (BLS) capabilities. These countries have made strides in integrating community-based healthcare workers into EMS, thereby extending the reach of emergency care to underserved populations. However, issues such as inadequate training, inconsistent service quality, and resource shortages continue to hinder optimal EMS performance (9).

By comparing these models, EMS in Iran can identify best practices that align with its unique needs and constraints. For example, adopting the physician-led model seen in Germany could enhance the quality of pre-hospital care, while integrating community-based approaches from LMICs could improve access in rural and remote areas. Furthermore, learning from the technological advancements in the U.S. and Europe could guide the integration of digital tools in Iran's EMS system .

Key performance indicators (KPIs) in EMS quality:

KPIs are critical in assessing and improving the quality of EMS. These indicators provide measurable benchmarks that can be used to evaluate various aspects of EMS delivery, ensuring that services meet established standards and patient needs (10). The most important KPIs are explained below:

Response time is one of the most universally recognized KPIs in EMS. It refers to the time taken from the initial emergency call to the arrival of EMS personnel at the scene. Shorter response times are generally associated with better patient outcomes, particularly in time-sensitive emergencies such as cardiac arrests and severe trauma. In many high-income countries, benchmarks have been established, such as the "8-minute response time" for life-threatening emergencies, used in the UK and parts of the U.S. (10, 11).

Patient survival rates, particularly for conditions like out-of-hospital cardiac arrest (OHCA), are also vital KPIs. These rates reflect the effectiveness of pre-hospital care, including the promptness of defibrillation, the quality of CPR, and the availability of ALS services. High survival rates are often seen in EMS systems with well-trained personnel and strong community engagement in emergency response, such as the widespread public availability of Automated External Defibrillators (AEDs) in Japan and parts of Europe (10, 11).

Other KPIs include the accuracy of triage and diagnosis, patient satisfaction, and the efficiency of patient handover to hospital care. Accurate triage ensures that patients receive appropriate care based on the severity of their condition, reducing the likelihood of adverse outcomes. Patient satisfaction metrics provide insights into the quality of care from the patient's perspective, encompassing aspects such as the professionalism of EMS personnel, the quality of communication, and the overall experience of care (10, 11).

Incorporating these KPIs into Iran's EMS evaluation framework will be crucial for continuous quality improvement. By benchmarking against international standards, Iran can set realistic goals for its EMS system, focusing on areas such as response time reduction, improved patient survival rates, and enhanced patient satisfaction. These KPIs will not only help monitor performance but also guide strategic initiatives aimed at elevating the overall quality of pre-hospital emergency care in the country. Table 1 provides a comprehensive overview of KPIs in EMS quality, including their quality aspects, consequences of non-compliance, and solutions to address issues (12).

Table1: comprehensive overview of KPIs in EMS quality (10, 11)

KPI	Quality	Consequences of Non-Compliance	Solutions to Address Issues
Response Time	Average time to respond to calls	Increased delays and reduced patient satisfaction	Improve resource management and allocation, use advanced technologies
Patient Transport Time	Average time to transport patients to hospital	Increased hospital stay, worsened patient conditions	Improve route planning, upgrade equipment, and train staff
Accuracy of Diagnosis and Treatment	Percentage of accurate emergency diagnoses and treatments	Misdiagnosis and inadequate treatment	Ongoing staff training, use standard protocols
Patient Satisfaction	Patient satisfaction levels with EMS services	Dissatisfaction and decreased public trust	Enhance service quality, collect and analyze patient feedback
Patient Survival Rate	Percentage of patient survival and	Increased mortality and complications due	Improve service quality, closely

	improvement	to delayed treatment	monitor processes
Medical Errors	Number of reported medical errors	Negative treatment outcomes, patient harm	Improve staff training and oversight
Staff Safety	Percentage of safety incidents involving staff	Increased injuries and reduced performance	Provide appropriate training and equipment, improve working conditions
Equipment Utilization	Percentage of proper use of medical equipment	Decreased equipment effectiveness and efficiency	Regular maintenance and repair, staff training
Unnecessary Services	Number of services deemed unnecessary	Unnecessary costs, increased system burden	Improve service selection protocols, train physicians
Complaints and Feedback	Number of complaints and negative feedback	Reduced service quality, patient dissatisfaction	Address complaints, enhance performance and services

Methodological approaches for quality assessment in EMS

Quantitative and qualitative assessment techniques: In evaluating the quality of EMS, both quantitative and qualitative assessment techniques are essential for a comprehensive understanding. Quantitative methods typically involve measurable data, such as response times, patient survival rates, and resource utilization metrics. These indicators provide a concrete basis for assessing the efficiency and effectiveness of EMS systems (2). Techniques such as statistical analysis, benchmarking, and performance metrics are commonly used to analyze large datasets and identify areas needing improvement. Qualitative techniques, on the other hand, focus on the experiential aspects of EMS quality, such as patient satisfaction, staff morale, and organizational culture. Methods like interviews, focus groups, and case studies are employed to gather in-depth insights that quantitative data might overlook. Qualitative assessments allow for a more nuanced understanding of the underlying factors influencing EMS performance, such as communication, teamwork, and decision-making processes. Combining these approaches ensures a balanced evaluation, capturing both the measurable outcomes and the contextual factors affecting EMS quality (13).

Use of artificial intelligence (AI) in EMS quality evaluation: The integration of data analytics and AI in EMS quality evaluation has revolutionized the way performance is monitored and improved. Advanced data analytics enables real-time monitoring of EMS operations, facilitating the early detection of trends and anomalies. Predictive analytics, powered by AI, can forecast demand for EMS services, optimize resource allocation, and reduce response times. For example, machine learning algorithms can predict the likelihood of certain medical emergencies based on historical data, allowing EMS systems to prepare accordingly. AI also enhances decision-making processes by providing actionable insights derived from complex datasets. In quality assessment, AI-driven tools can identify patterns that human analysts might miss, such as correlations between patient outcomes and specific operational practices. Moreover, AI can automate routine tasks, freeing up EMS personnel to focus on patient care. The use of AI and data analytics not only improves the accuracy and efficiency of quality assessments but also contributes to the continuous improvement of EMS systems by enabling data-driven decision-making (14).

Patient-centered outcomes and satisfaction metrics: Patient-centered outcomes and satisfaction metrics are increasingly recognized as critical components of EMS quality assessment. These metrics focus on the patient's perspective, evaluating the quality of care based on factors that matter most to patients, such as the timeliness of care, communication with healthcare providers, and overall satisfaction with the EMS experience. Tools like patient surveys, feedback forms, and post-discharge interviews are commonly used to gather data on these aspects (15).

Applying patient-centered metrics into EMS quality assessments ensures that the evaluation process aligns with the ultimate goal of healthcare. Improving patient outcomes and satisfaction. By prioritizing the patient's voice, EMS systems can identify areas where patient expectations are not being met and implement changes to enhance the patient experience. Additionally, patient-centered outcomes provide a more holistic view of EMS quality, complementing the traditional focus on clinical and operational

metrics. This approach not only improves patient satisfaction but also fosters trust and confidence in EMS services, leading to better overall healthcare outcomes (16).

Developing a quality assessment model for EMS in Iran

Contextual considerations for Iran:

In developing a quality assessment model for EMS in Iran, it is crucial to consider the unique contextual factors that influence healthcare delivery in the country. Iran's healthcare system operates within a complex socio-political and economic landscape, characterized by regional disparities, varying levels of infrastructure, and a diverse population with differing health needs. The healthcare system is also shaped by Iran's specific cultural, religious, and social values, which play a significant role in determining how EMS is perceived, accessed, and utilized by the public (17).

Iran's geographical diversity, ranging from urban centers with advanced medical facilities to remote rural areas with limited access to healthcare, presents significant challenges for EMS. The disparity in resources and infrastructure between urban and rural settings requires a tailored approach to quality assessment that accounts for these differences. Additionally, the ongoing economic sanctions have impacted the availability of medical supplies and the capacity for technological advancements, further complicating efforts to standardize and improve EMS quality across the nation (1, 18, 19).

Moreover, Iran's healthcare policies are influenced by the broader political context, including the role of governmental and non-governmental organizations in health service delivery. Understanding the regulatory framework, including the Ministry of Health and Medical Education's policies, is essential in designing an effective quality assessment model. This framework must also align with the overarching goals of Iran's health system, such as achieving equity in healthcare access, enhancing patient safety, and improving overall health outcomes.

Integration of international best practices with local needs

Incorporating international best practices into Iran's EMS quality assessment model is a strategic approach to enhancing the effectiveness and reliability of the system. However, this integration must be done with careful consideration of the local context to ensure that the adopted practices are relevant and applicable. International models, such as those used in the United States, the United Kingdom, and other developed countries, offer valuable insights into successful EMS operations, including the use of standardized protocols, advanced technology, and continuous quality improvement mechanisms (20). However, the direct transfer of these practices to Iran's EMS system requires adaptation to meet local needs and conditions. For example, while advanced data analytics and real-time monitoring systems are integral to EMS quality assessment in developed countries, the implementation of such technologies in Iran must consider the availability of resources, technical expertise, and infrastructure. Additionally, the cultural and social norms that influence patient interactions with EMS providers in Iran must be respected and integrated into the model to ensure its acceptance and effectiveness. To achieve this balance, it is essential to engage in a thorough analysis of the international practices that have been successful in comparable healthcare settings. These practices can then be modified to suit Iran's unique challenges and opportunities. The integration process should involve piloting and testing adapted practices in select regions of Iran to gather data and feedback, which can inform broader implementation across the country (21).

Stakeholder involvement in model design

The development of a quality assessment model for EMS in Iran requires active and sustained involvement from a wide range of stakeholders. These stakeholders include healthcare professionals, government officials, policymakers, patients, and community representatives. Each group brings a unique perspective and expertise that is critical to creating a comprehensive and effective model (22).

Healthcare professionals, including EMS providers, doctors, and nurses, are on the front lines of emergency care and have firsthand knowledge of the challenges and opportunities within the current system. Their input is invaluable in identifying areas for improvement and ensuring that the quality assessment model addresses the practical realities of EMS delivery. Engaging these professionals in the design process helps to build a model that is both feasible and relevant to the needs of those who will be using it daily (23).

Government officials and policymakers are responsible for ensuring that the quality assessment model aligns with national health priorities and regulations. Their involvement is crucial for securing the necessary resources, enacting supportive policies, and facilitating the integration of the model into the

broader healthcare system. Additionally, their support is vital for the sustainability and scalability of the model across different regions of Iran. Patient and community involvement is also essential to ensure that the model reflects the needs and expectations of those who rely on EMS services. This group can provide valuable feedback on patient satisfaction, accessibility, and cultural sensitivity, which are critical components of quality in EMS. By incorporating the voices of patients and communities, the model can be designed to improve patient outcomes and enhance public trust in the EMS system. Finally, collaboration between these stakeholders must be structured and ongoing, with regular consultations and feedback loops. This collaborative approach ensures that the quality assessment model is dynamic, adaptable, and capable of responding to the evolving needs of Iran's EMS system. It also fosters a sense of ownership and commitment among stakeholders, which is essential for the successful implementation and continuous improvement of the model (24).

Implementing the EMS quality assessment model in Iran

The successful implementation of the EMS quality assessment model in Iran involves a multi-phase approach that ensures the model is adaptable, scalable, and capable of achieving the desired outcomes across the diverse healthcare landscape of the country. This process begins with establishing clear implementation guidelines that delineate roles, responsibilities, and timelines for each stage of deployment. The guidelines must account for the varying levels of infrastructure and resource availability across Iran, ensuring that the model is flexible enough to accommodate regional differences while maintaining a consistent standard of quality (25).

The implementation strategy should also include a comprehensive communication plan to inform all stakeholders ranging from EMS providers to policymakers about the goals, processes, and expected outcomes of the model. This communication is critical for fostering buy-in and collaboration, ensuring that all parties are aligned with the objectives and committed to the model's success. Moreover, the implementation phase must incorporate continuous monitoring and evaluation mechanisms to track progress, identify challenges, and make necessary adjustments. This iterative approach allows for real-time problem-solving and ensures that the model remains responsive to the needs of the EMS system and its stakeholders (26).

Pilot testing and feedback mechanisms

Pilot testing is a crucial step in implementing the EMS quality assessment model, as it allows for the practical application of the model in a controlled environment. The pilot phase should be conducted in selected regions that represent the diverse healthcare contexts within Iran, including urban, rural, and underserved areas. This diversity in testing sites will provide valuable insights into how the model performs under different conditions and highlight any region-specific adaptations that may be necessary. During the pilot phase, data collection should focus on KPIs related to EMS quality, such as response times, patient outcomes, and provider adherence to protocols. These KPIs will serve as benchmarks to evaluate the effectiveness of the model and guide refinements. Importantly, feedback from EMS providers, patients, and other stakeholders should be systematically gathered through surveys, interviews, and focus groups. This feedback is vital for understanding the practical challenges of the model and identifying opportunities for improvement. The pilot phase should also involve a detailed analysis of the data collected, with a focus on identifying trends, successes, and areas for enhancement. Based on this analysis, the model can be refined and optimized before being rolled out on a larger scale. This phased approach reduces the risk of widespread implementation failures and ensures that the model is robust and well-suited to the realities of the Iranian EMS system (27).

Training and capacity building for EMS providers

A critical component of implementing the EMS quality assessment model is the training and capacity building of EMS providers. The effectiveness of the model hinges on the ability of EMS personnel to accurately assess and improve their performance according to the standards and metrics defined within the model. Therefore, a comprehensive training program must be developed and delivered to all EMS providers, from front-line responders to managerial staff (28, 29).

The training program should cover the principles of quality assessment, the specific KPIs relevant to EMS, and the tools and technologies that will be used for data collection and analysis. Additionally, the program should emphasize the importance of continuous improvement and encourage providers to actively engage with the quality assessment process. Practical training sessions, such as simulations and role-playing exercises, can be highly effective in helping providers understand how to apply the model in real-world scenarios (29).

Capacity building efforts should also include the development of leadership and management skills among EMS supervisors, who play a key role in overseeing the quality assessment process and ensuring

that the model is implemented consistently across their teams. Furthermore, ongoing professional development opportunities should be offered to EMS providers to keep them updated on the latest best practices in EMS quality management. To support these efforts, partnerships with academic institutions, professional organizations, and international experts can be established to provide additional resources and expertise. These collaborations can also facilitate the exchange of knowledge and experiences, helping to build a culture of excellence and accountability within the Iranian EMS system (30).

Policy recommendations for sustainable implementation

For the EMS quality assessment model to be successfully and sustainably implemented in Iran, supportive policies must be enacted at the national and regional levels. These policies should focus on creating an enabling environment for quality improvement, including the allocation of adequate resources, the establishment of regulatory frameworks, and the provision of incentives for high performance. One key policy recommendation is the integration of the EMS quality assessment model into the broader national health strategy. This integration ensures that EMS quality improvement is aligned with other health system goals, such as universal health coverage and the enhancement of patient safety. Additionally, policies should be developed to secure long-term funding for the implementation and maintenance of the quality assessment model, including investments in technology, training, and infrastructure. Regulatory policies are also needed to standardize the quality assessment process across the country. These regulations should define the roles and responsibilities of various stakeholders, establish minimum quality standards, and outline the consequences of non-compliance. Moreover, the government should consider implementing accreditation programs for EMS providers that meet or exceed the established quality standards, thereby incentivizing continuous improvement (31).

Another important policy consideration is the establishment of a robust data governance framework. This framework should address issues related to data privacy, security, and interoperability, ensuring that the data collected through the quality assessment process is accurate, reliable, and accessible to all relevant stakeholders. Additionally, policies should encourage the use of data analytics and artificial intelligence to enhance the quality assessment process and provide actionable insights for decision-makers. Finally, policies that promote stakeholder engagement and collaboration are essential for the sustained success of the EMS Quality Assessment Model. These policies should facilitate regular consultations between EMS providers, patients, government agencies, and other stakeholders, ensuring that the model remains relevant and responsive to the evolving needs of the Iranian healthcare system. By fostering a culture of collaboration and continuous improvement, these policies can help to ensure that the EMS Quality Assessment Model contributes to significant and lasting enhancements in the quality of emergency medical services in Iran (32).

Challenges and opportunities in implementing EMS quality models in Iran

Barriers to adoption and scale-up

One of the primary barriers to adopting and scaling up EMS quality models in Iran is the variability in infrastructure and resource availability across different regions. In urban areas, where healthcare facilities are more developed, the implementation of such models may be more straightforward. However, in rural and underserved areas, where resources are limited, and access to advanced medical care is challenging, implementing standardized quality models becomes significantly more difficult. This disparity can result in uneven quality of EMS across the country, undermining the overall effectiveness of the quality models (33).

Another significant barrier is the lack of a unified regulatory framework for EMS. Without clear regulations and standards, there is a risk of inconsistent application of quality models, which can lead to variability in service delivery and patient outcomes. Additionally, the absence of a strong regulatory environment can make it difficult to enforce compliance with quality standards, further complicating the adoption and scale-up of EMS quality models (33).

Resistance to change among EMS providers is also a notable challenge. Implementing new quality models often requires changes in established practices and workflows, which can be met with resistance from personnel accustomed to existing methods. This resistance can be exacerbated by a lack of training and awareness regarding the benefits of the new models, leading to reluctance to adopt new practices. Financial constraints pose another significant challenge. Implementing comprehensive EMS quality models requires substantial investment in technology, training, and infrastructure. In a resource-constrained environment, securing the necessary funding for these initiatives can be difficult, particularly when competing with other healthcare priorities. This financial barrier can limit the scope

and scale of quality improvement efforts, hindering their potential impact (Table2) (34).

Table 2: barriers to the adoption of EMS quality models in Iran, and thier potential solutions (34)

Barrier	Description	Solutions
Financial Constraints	Limited funding and resources for implementing quality models	Increase investment in EMS, explore public-private partnerships, and optimize resource allocation
Infrastructure Limitations	Insufficient or outdated infrastructure and equipment	Upgrade facilities and equipment, and ensure proper maintenance
Regulatory Challenges	Complex and restrictive regulations affecting implementation	Streamline regulations, and engage in policy advocacy for supportive changes
Resistance to Change	Hesitancy or opposition from EMS personnel and management	Foster a culture of change through leadership and effective communication, and involve staff in decision-making
Lack of Training and Education	Inadequate training programs for EMS personnel	Develop comprehensive training programs, and provide continuous professional development
Inconsistent Quality Standards	Variability in quality standards across different regions	Establish and enforce uniform standards, and conduct regular audits
Limited Stakeholder Engagement	Insufficient involvement of key stakeholders in the process	Increase stakeholder engagement through consultations and collaboration
Data Management Issues	Poor data collection, management, and analysis practices	Implement robust data management systems, and ensure accurate and timely reporting
Technological Barriers	Lack of access to or integration of advanced technologies	Invest in modern technology, and integrate it into EMS systems
Cultural and Socioeconomic Factors	Societal attitudes and economic disparities affecting EMS delivery	Address cultural barriers through community engagement, and provide targeted support to underserved areas

Opportunities for innovation and improvement

Despite these challenges, there are several opportunities for innovation and improvement in the implementation of EMS quality models in Iran. One of the most promising opportunities lies in leveraging technology to enhance the efficiency and effectiveness of EMS. The integration of digital health tools, such as telemedicine, mobile health applications, and data analytics, can help overcome some of the logistical challenges associated with implementing quality models, particularly in rural and remote areas. These technologies can enable real-time monitoring and assessment of EMS performance, providing valuable data to guide continuous improvement efforts (35).

Another opportunity for innovation is the customization of EMS quality models to better align with local needs and contexts. By incorporating cultural, social, and regional factors into the design and implementation of quality models, it is possible to create more relevant and effective frameworks that resonate with both providers and patients. This localized approach can enhance buy-in from stakeholders and improve the likelihood of successful adoption and scale-up (36).

Capacity building and training programs also offer significant opportunities for improvement. By investing in the education and professional development of EMS providers, it is possible to equip them with the skills and knowledge necessary to implement and sustain quality improvement initiatives. This includes not only technical training but also education on the principles of quality management and the importance of continuous improvement. Such programs can help mitigate resistance to change and foster a culture of quality within the EMS system (18).

Collaboration and partnerships present another key opportunity. By fostering collaborations between government agencies, academic institutions, international organizations, and private sector partners, it is possible to pool resources and expertise to support the implementation of EMS quality models. These

partnerships can facilitate knowledge exchange, provide access to additional funding, and introduce best practices from other countries, helping to overcome some of the barriers to adoption and scale-up (37). Finally, there is an opportunity to engage patients and the broader community in the EMS quality improvement process. By involving patients in the design and evaluation of quality models, it is possible to ensure that the models are patient-centered and responsive to the needs of the community. This engagement can also help build public trust and support for EMS services, further enhancing the effectiveness of quality improvement efforts (37).

In total, while there are significant challenges to implementing EMS quality models in Iran, there are also numerous opportunities for innovation and improvement. By addressing the barriers to adoption and scale-up and leveraging the opportunities for innovation, it is possible to create effective and sustainable EMS quality models that improve patient outcomes and enhance the overall quality of emergency medical services in Iran.

Conclusion

In conclusion, our review showed that the development and implementation of a quality assessment model for EMS in Iran highlight several critical insights. Key challenges include significant disparities in healthcare infrastructure between urban and rural areas, which complicate the uniform application of quality standards. Integrating international best practices with local needs and involving stakeholders in the design and implementation phases are crucial for creating relevant and sustainable quality models. Despite barriers such as financial constraints and resistance to change, opportunities for innovation through technology and collaboration offer promising solutions. Future research should focus on longitudinal impact studies, technology integration, regional comparative analyses, patient-centered outcomes, policy and regulatory influences, cross-country comparisons, and innovative training programs to enhance EMS quality and effectiveness.

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