ISSN: 2663-5798 || Arab Journal for Scientific Publishing

الإصدار الثامن – العدد الثالث والثمانون
تاريخ الإصدار: 2 – ايلول – 2025م
www.ajsp.net

"Prehospital Emergency Medical Care in Saudi Arabia a Systematic Review (2015–2025)"

Researchers:

Hassan Mohammed Al Hamam[1], Raed Abdulqader Aljohani[2], Meshal Ibrahim Aljohani[3], Abdullah Mohammed Al-Sahli[4], Munaji Alwan Aljaafari[5], Saif Falah Alsahli[6], Khalid Raji Makki[7], Abdullah Mansour Al Ahmadi[8], Mazen Sadiq Al Muzaini[9], Saud Saeed Al Marwani[10], Ahmed Mubarak Alrashed[11], Suliman Muflih Alharbi[12]

ISSN: 2663-5798 || Arab Journal for Scientific Publishing

الإصدار الثامن – العدد الثالث والثمانون
تاريخ الإصدار: 2 – ايلول – 2025م
www.ajsp.net

Abstract

Background:

Prehospital emergency medical care (PEMC) plays a vital role in reducing mortality and improving outcomes in acute medical and trauma emergencies. In Saudi Arabia, the Saudi Red Crescent Authority (SRCA) oversees the national Emergency Medical Services (EMS) system, which has undergone significant transformation in alignment with Vision 2030. Despite advancements in digital integration and infrastructure, challenges persist regarding response time, workforce readiness, and clinical outcomes.

Objective:

This systematic review aims to synthesize current evidence on the structure, performance, challenges, and innovations of prehospital emergency medical care in Saudi Arabia between 2015 and 2025.

Methods:

Following the **PRISMA 2020** guidelines, comprehensive searches were conducted across PubMed, Scopus, Web of Science, ScienceDirect, and Google Scholar. Additional data were retrieved from SRCA and Vision 2030 publications. Eligible studies included quantitative, qualitative, and mixed-methods research focusing on EMS performance, response intervals, clinical outcomes, workforce development, and digital transformation. Twenty-seven studies and national reports met inclusion criteria.

Results:

The review identified continuous growth in EMS coverage and technological capacity. Median response times ranged from **8–11 minutes in urban** to **15–20 minutes in rural** regions. Out-of-hospital cardiac arrest (OHCA) outcomes remain low, with **return of spontaneous circulation (ROSC)** around **7.4%** and **survival to discharge at 2.9%**. Digital platforms such as **Asefny** and **Al-Mustajeeb** enhanced accessibility but introduced variability in response efficiency. Workforce studies revealed ongoing challenges related to training, clinical autonomy, and burnout. Public awareness improved modestly, yet bystander CPR and AED utilization remain limited.

Conclusion:

Between 2015 and 2025, Saudi Arabia's prehospital emergency medical care system achieved substantial modernization, reflecting the strategic goals of Vision 2030. While digital innovation and operational expansion have improved access, persistent gaps in response time, cardiac arrest survival, and workforce capacity require targeted reforms. Strengthening EMS training, integrating data systems, and promoting public participation are essential for achieving high-quality, patient-centered prehospital care nationwide.

Keywords:

Prehospital care, Emergency Medical Services, Saudi Red Crescent Authority, Response time, Cardiac arrest, Vision 2030, Systematic review

1. EMS, SRCA – Madinah
2. EMT, SRCA – Madinah
3. EMT, SRCA – Madinah
4. EMT, SRCA – Madinah
5. EMT, SRCA – Madinah
6. EMT, SRCA – Madinah
7. EMS, SRCA – Madinah
8. EMS, SRCA – Madinah
9. EMT, SRCA – Madinah
10. EMT, SRCA – Madinah
11. EMS, SRCA – Eastern Province
12. EMT, SRCA – Madinah

Introduction

Prehospital emergency medical care (PEMC) is a critical link in Saudi Arabia's acute care continuum, where injury, cardiovascular, and medical emergencies remain leading causes of morbidity and mortality. The Saudi Red Crescent Authority (SRCA)—the national public EMS provider—operates an Anglo-American model staffed by emergency medical technicians (EMTs) and paramedics, and increasingly augments field operations with digital tools such as the **Asefny** and **Al-Mustajeeb** mobile applications for rapid activation, geolocation, accessibility for people with disabilities, and first-responder mobilization (e.g., dual alerts to public services and nearby responders) (SRCA, 2025). These efforts align with the **Health Sector Transformation Program** under **Vision 2030**, which prioritizes improved access, quality, and efficiency across urgent and emergency pathways (Vision 2030, 2025).

Despite these advances, national data highlight persistent challenges. Road traffic injuries (RTIs) remain a major EMS workload driver; analysis of **95,372** SRCA-attended crashes (2016–2020) found "excellent" dispatch acceptance and movement intervals but slower "duration at scene" and transport segments, signaling system bottlenecks after initial mobilization (Alslamah et al., 2023). Out-of-hospital cardiac arrest (OHCA) outcomes remain modest: the first Saudi OHCA registry (**SOHAR**) reported prehospital return of spontaneous circulation (ROSC) in **7.4%** and survival to discharge in **2.9%**, with < 1% achieving favorable neurological status—underscoring opportunities in early recognition, bystander CPR/AED use, and advanced prehospital care (Alabdali et al., 2024). During the COVID-19 period, SRCA's national OHCA snapshot showed a median CPR-initiation response of **13 minutes** with ROSC ~**8%**, reflecting pandemic-era operational strain and the need to compress time-to-care (Alsofayan et al., 2021).

Public engagement and access modalities have evolved. A national survey during COVID-19 found **66%** awareness of the **997** EMS number and higher acceptance/≤8-minute arrival rates when requests were placed via **997** compared with the Asefny app during lockdown, suggesting complementary roles but different acuity mixes and workflow performance (Aljabri & Albinali, 2022). Concurrently, demographic shifts are reshaping case-mix. Reviews and qualitative fieldwork point to growing geriatric trauma demand, gaps in geriatric-specific EMS training, fragmented trauma pathways, and limited data integration between prehospital and hospital settings—issues now targeted by Vision-aligned clinical advisory groups (Harthi et al., 2024; Harthi et al., 2025).

Together, these trends motivate a systematic review of **prehospital emergency medical care in Saudi Arabia (2015–2025)** to synthesize evidence on system performance (response intervals, triage, and clinical outcomes), digital transformation (apps, public-access defibrillation, dispatch innovations), workforce capacity (training, scope of practice), and population-level equity (urban–rural, geriatric needs). Such a synthesis can inform SRCA and national stakeholders as they refine EMS operations, strengthen trauma and cardiac arrest chains of survival, and deliver on Vision 2030 goals for timely, high-quality, patient-centered prehospital care. Recent national registries, multicenter datasets, Vision policy documents, and peer-reviewed studies provide an empirical foundation for this assessment and for delineating priority interventions in the next phase of EMS transformation (Alabdali et al., 2024; Alslamah et al., 2023; Harthi et al., 2024, 2025; SRCA, 2025; Vision 2030, 2025).

Literature Review

1. Overview of Prehospital Emergency Medical Services (EMS)

Prehospital emergency medical services are a critical component of the healthcare continuum, bridging the gap between incident occurrence and hospital care. EMS systems aim to provide timely, life-saving interventions, minimize morbidity, and ensure continuity of care from scene to hospital (Peden et al., 2023). Globally, EMS models vary—*Anglo-American* systems emphasize rapid patient transport with advanced prehospital interventions, while *Franco-German* models favor physician-led on-scene treatment (Alotaibi & Aljerian, 2022). Saudi Arabia follows a hybrid Anglo-American structure under the **Saudi Red Crescent Authority (SRCA)**, integrating public, private, and hospital-based response networks (SRCA, 2025).

The Kingdom's EMS expansion over the last decade has been driven by **Vision 2030**'s Health Sector Transformation Program, emphasizing accessibility, digitalization, and improved emergency readiness (Vision 2030, 2025). Prehospital services have extended coverage from urban to remote areas, incorporating air ambulance fleets and advanced communication technologies (Alsalamah et al., 2023).

2. Structure and Organization of EMS in Saudi Arabia

The SRCA serves as the main national EMS provider, operating across all 13 regions and managing both *land* and *air ambulance* services. It handles over **1.8 million annual emergency calls**, with approximately **65–70%** being medical emergencies and **30–35%** related to trauma (SRCA, 2025). Dispatch operations are organized via a centralized command system utilizing GPS and Computer-Aided Dispatch (CAD) technology.

Recent reforms have sought to reduce duplication between SRCA and hospital-based ambulance fleets by introducing **integrated dispatch centers** and **electronic patient care records (ePCR)** (Alghamdi et al., 2021). Despite these advances, operational challenges persist—particularly **prolonged scene times**, **workforce shortages**, and **limited clinical autonomy for paramedics** (Harthi et al., 2025).

3. Response Time and System Performance

Response time remains a key indicator of EMS quality. The SRCA's target is ≤8 minutes for urban and ≤15 minutes for rural responses (SRCA, 2025). However, empirical data suggest ongoing challenges: Alslamah et al. (2023) reported median response times of **8–11 minutes** in urban regions and **15–20 minutes** in rural areas. Factors influencing delay include **traffic congestion**, **caller geolocation errors**, and **uneven distribution of ambulance stations** (Mahmud et al., 2022).

Benchmark comparisons reveal that Saudi Arabia's average response intervals are slightly longer than those in high-income systems such as the UK or Australia (6–8 minutes) (Peden et al., 2023). Yet, progressive digitization—particularly GIS-linked route optimization and dynamic vehicle positioning—has shortened **call-to-dispatch intervals by approximately 22%** between 2020 and 2024 (SRCA, 2025).

4. Trauma and Road Traffic Injury Burden

Trauma—especially road traffic injuries (RTIs)—represents the leading cause of EMS utilization and a primary contributor to premature mortality in Saudi Arabia (Mahmud et al., 2022). National registry analyses revealed that **young males (18–35 years)** account for nearly **80%** of trauma-related calls. Although dispatch activation and movement intervals are efficient, the **on-scene phase** remains the most time-consuming. This delay often results from extrication complexity, inadequate coordination with police and civil defense, and limited access to advanced prehospital trauma procedures such as hemorrhage control and intubation (Alotaibi & Aljerian, 2022).

Geriatric trauma, previously under-recognized, is increasingly significant. Harthi et al. (2024) found that older adults (≥65 years) experience disproportionately higher mortality and under-triage rates due to nonspecific injury mechanisms and comorbidities. Their subsequent qualitative study (Harthi et al., 2025) highlighted EMS staff's limited training in geriatric assessment and communication, prompting calls for age-specific trauma triage algorithms and simulation-based training.

5. Out-of-Hospital Cardiac Arrest (OHCA) and Resuscitation Outcomes

Out-of-hospital cardiac arrest (OHCA) outcomes in Saudi Arabia remain below global standards. The **Saudi OHCA Registry (SOHAR)** reported a **7.4%** prehospital return of spontaneous circulation (ROSC) and **2.9%** survival to discharge (Alabdali et al., 2024). These rates mirror patterns in other Gulf countries and are influenced by low **bystander CPR (≈9%)**, minimal **public AED use (<2%)**, and delayed **EMS arrival (>10 minutes)** (Alsofayan et al., 2021).

Pilot community responder programs in Riyadh and Jeddah improved ROSC to approximately **10%**, emphasizing the potential of *first-responder networks* (Aljerian et al., 2024). Integration of **AED location mapping** and **dispatcher-assisted CPR** within the Asefny mobile application (version 3.0, launched 2024) is anticipated to improve early survival.

6. Digital Transformation and Public Accessibility

Digital health transformation has reshaped Saudi EMS operations. The **Asefny** and **Al-Mustajeeb** mobile applications allow users to request ambulances, share GPS coordinates, and access real-time tracking and multilingual support (SRCA, 2025). During the COVID-19 pandemic, app utilization increased by **38%**, facilitating service access among people with hearing or speech impairments (Aljabri & Albinali, 2022).

Comparative analyses indicated that while app-initiated requests had **slightly longer median response times (10–12 min)** than 997 calls (**8 min**), they improved **data accuracy, user accessibility, and inclusion of special-needs populations**. Such digitalization directly supports **Vision 2030's e-Health and Smart Governance objectives** (Vision 2030, 2025).

7. Workforce Competency and Professional Development

The EMS workforce has expanded rapidly, but challenges persist in skill uniformity and professional identity. Studies highlight **limited clinical autonomy**, **burnout**, and **variability in training pathways** between EMTs and paramedics (Alhamad et al., 2020). The Saudi Commission for Health Specialties (SCFHS) has introduced national **competency frameworks** and **continuing professional development (CPD)** requirements, emphasizing simulation-based education and standardized evaluation (Harthi et al., 2025).

Emerging initiatives include university-based paramedic degrees and postgraduate diplomas in emergency medicine, reflecting a national commitment to professionalize prehospital care (Alotaibi & Aljerian, 2022). Sustained investment in workforce well-being, role clarity, and training infrastructure remains pivotal for achieving high-quality EMS delivery.

8. Public Awareness, Engagement, and Patient Experience

Public engagement is critical for effective EMS systems. Surveys show **moderate satisfaction (70–75%)** with SRCA services but persistent gaps in communication, cultural sensitivity, and rural awareness of emergency access numbers (Aljabri & Albinali, 2022). Community-based CPR education programs, often led by universities and NGOs, have demonstrated increased willingness to perform CPR and improved basic life-support knowledge among laypersons (Alshahrani et al., 2023).

Patient-centered strategies—such as real-time app updates, gender-sensitive staffing in conservative regions, and multilingual helplines—have improved trust and perceived safety among tourists and residents alike.

9. Research Gaps and Future Directions

Despite expanding evidence, gaps persist in **nationwide EMS data integration**, **prospective outcome monitoring**, and **evaluation of digital initiatives**. Most studies remain cross-sectional or retrospective, limiting causal inference. Future research should focus on longitudinal outcome tracking, AI-supported triage algorithms, and comprehensive cost-effectiveness analyses of EMS modernization projects.

Integration of **prehospital and hospital data systems**, including emergency department outcomes, would enable comprehensive performance benchmarking and continuous quality improvement—core goals of Vision 2030's health transformation agenda.

Summary

The literature between 2015 and 2025 demonstrates significant strides in Saudi Arabia's EMS system, driven by digital transformation, increased regional coverage, and regulatory reforms. However, systemic inefficiencies persist in response intervals, workforce capacity, and bystander participation. Strengthening EMS governance, research infrastructure, and cross-sector collaboration is essential to achieving a resilient, patient-centered prehospital care system that aligns with international standards.

Table 1. Summary of Included Studies (2015–2025)

No.	Author(s), Year	Study Design	Setting / Sample	Focus Area	Key Findings	Implications
1	**Alslamah et al. (2023)**	Retrospective national registry analysis	95,372 RTI calls (2016–2020)	EMS response time	Median response 8–11 min; scene duration main delay	Optimize scene management; GIS route planning
2	**Alsofayan et al. (2021)**	Cross-sectional (COVID-19)	1,125 OHCA incidents	Cardiac arrest outcomes	ROSC 8%; median response 13 min	Improve dispatcher-assisted CPR and PPE training
3	**Alabdali et al. (2024)**	Multicenter registry	SOHAR national database	OHCA registry	ROSC 7.4%; survival 2.9%	Expand bystander CPR/AED programs

4	**Aljabri & Albinali (2022)**	Survey	n = 3,600 citizens	Public awareness of 997 vs. Asefny	66% awareness of 997; app slower but more accessible	Enhance education and app-based engagement
5	**Harthi et al. (2024)**	Scoping review	Saudi hospitals (2015–2023)	Geriatric trauma care	Fragmented trauma systems; lack of elderly triage	Create geriatric trauma pathway
6	**Harthi et al. (2025)**	Qualitative interviews	20 paramedics/EMTs	Workforce perspectives	Limited geriatric skills, autonomy issues	Introduce geriatric simulation modules
7	**Mahmud et al. (2022)**	Retrospective hospital-based	1,800 trauma cases	RTI outcomes	High prehospital mortality (15%)	Reinforce ALS training for field airway management

8	**Alghamdi et al. (2020)**	Cross-sectional	12 EMS regions	Urban vs. rural disparities	Rural areas 40% slower responses	Decentralize EMS dispatch bases
9	**Alhamad et al. (2020)**	Qualitative	25 EMS professionals	Workforce stress	Job strain, limited CPD	Formalize continuing education framework
10	**Aljerian et al. (2024)**	Pilot project	Community First Responder network	OHCA	ROSC 10% with rapid volunteer CPR	Scale volunteer responder programs
11	**SRCA (2025)**	Institutional report	National	Digital health services	Asefny/Al-Mustajeeb integration	Increase accessibility and interoperability
12	**Vision 2030 (2025)**	Government report	National	Health sector transformation	Integration and efficiency targets	Continuous EMS modernization

Methods

Study Design

This review followed the **Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020)** guidelines to ensure methodological transparency and reproducibility. The protocol was developed a priori to define eligibility criteria, data sources, search strategy, screening process, and synthesis approach (Page et al., 2021).

Eligibility Criteria

Studies were included if they met the following criteria:

- **Population:** Patients or incidents managed within the *prehospital emergency medical system* in Saudi Arabia (adult or pediatric).
- **Intervention/Exposure:** Any *prehospital emergency medical care activity*, including emergency dispatch, ambulance response, field triage, paramedic or EMT interventions, digital health applications (e.g., Asefny, Al-Mustajeeb), or public access systems.
- **Comparator:** Conventional or alternative EMS models, pre–post evaluations, or none (for descriptive studies).
- **Outcomes:** Response time, scene time, patient survival, bystander CPR/AED use, quality indicators, or satisfaction and operational efficiency.
- **Study Design:** Quantitative, qualitative, or mixed-methods studies; national registry reports; and policy evaluations conducted between **January 2015 and October 2025**.
- **Language:** English or Arabic.

Exclusion criteria were:

(a) case reports without system-level context;

(b) simulation-only or educational training papers not linked to actual prehospital care outcomes; (c) studies conducted outside Saudi Arabia.

Information Sources

Comprehensive searches were performed across PubMed/MEDLINE, Scopus, Web of Science, ScienceDirect, and Google Scholar. Supplementary searches targeted official Saudi sources including the Saudi Red Crescent Authority (SRCA) annual reports, the Saudi Health Council, and Vision 2030 Health Sector Transformation Program documents. Reference lists of eligible papers were also screened to identify additional studies.

Search Strategy

The Boolean search combined Medical Subject Headings (MeSH) and keywords:

("Emergency Medical Services" OR "Prehospital Care" OR "Ambulance Services") AND ("Saudi Arabia") AND ("Response Time" OR "Patient Outcomes" OR "Red Crescent" OR "Out-of-Hospital Cardiac Arrest" OR "Digital Health" OR "Asefny" OR "Mobile Applications").

Filters were applied to restrict to **2015–2025**, human subjects, and English/Arabic publications. The full search syntax was recorded for replication.

Selection Process

Two independent reviewers screened titles and abstracts for relevance. Full texts were reviewed for eligibility using inclusion/exclusion criteria. Disagreements were resolved through discussion or adjudication by a third reviewer. A PRISMA 2020 flow diagram documented the selection process, including total records identified, screened, excluded, and included.

Data Extraction and Management

A standardized data extraction form was designed in Microsoft Excel to capture:

- Author, year, study design, and setting;
- Population characteristics;
- Type of EMS intervention or system component evaluated;
- Key findings (response intervals, outcomes, satisfaction, quality metrics);
- Study limitations and recommendations.

Quality Appraisal

Methodological quality was independently assessed using the **Joanna Briggs Institute (JBI)** checklists appropriate to each design (cross-sectional, cohort, or qualitative). Scores were used descriptively to evaluate confidence in findings but not for exclusion unless studies were deemed critically flawed.

Data Synthesis

Given the heterogeneity of study designs and outcomes, a **narrative synthesis** was employed. Quantitative results (e.g., median response times, survival rates) were summarized in tables and figures. Qualitative insights (e.g., workforce challenges, digital tool adoption, patient perceptions) were analyzed thematically to identify recurrent domains and system gaps.

Ethical Considerations

This review analyzed previously published data and therefore did not require institutional ethics approval. The study adhered to the **Declaration of Helsinki** principles for transparency and research integrity.

Results

Study Selection

The initial database search retrieved **412 records**, of which **68** duplicates were removed. After screening **344 titles and abstracts**, **51 full-text articles** were reviewed. Finally, **24 studies** and **3 national reports** met the inclusion criteria (see PRISMA 2020 flow diagram in Appendix A). The included studies covered diverse EMS domains: operational performance (n = 8), out-of-hospital cardiac arrest (OHCA) and resuscitation (n = 5), trauma response (n = 4), digital transformation (n = 3), workforce development and training (n = 2), and public awareness or satisfaction (n = 2).

Characteristics of Included Studies

- **Study period:** 2015–2025
- **Geographic coverage:** 13 provinces; most studies from Riyadh, Jeddah, Eastern Province, and Aseer.
- **Study design:** 14 cross-sectional, 4 retrospective registry analyses, 3 cohort studies, 2 qualitative studies, 1 mixed-methods.
- **Populations:** General prehospital cases (n = 10), trauma/RTI victims (n = 6), cardiac arrest (n = 5), and EMS personnel (n = 6).

1. Operational Performance of EMS

Studies consistently identified **response time** as a central metric of service quality. National data analysis by Alslamah et al. (2023) showed median **response times between 8 and 11 minutes**, but **scene times averaged 18–22 minutes**, prolonging total prehospital duration. Urban–rural comparisons revealed longer response intervals in peripheral governorates, attributable to infrastructure, resource availability, and terrain (Alghamdi et al., 2020). Despite a national target of ≤8 minutes for urban areas (SRCA, 2025), only 61–68% of calls met this benchmark.

Factors contributing to delays included **traffic congestion**, **caller location uncertainty**, and **incomplete digital integration** between dispatch centers and hospitals. However, newer GIS-based systems implemented in 2022 improved call-to-dispatch time by 22%, marking progress toward Vision 2030 benchmarks (Vision 2030, 2025).

2. Out-of-Hospital Cardiac Arrest (OHCA)

Five major studies (Alsofayan et al., 2021; Alabdali et al., 2024) described poor survival outcomes.

- **ROSC rates** ranged from **6.5–8%** nationally.
- **Survival to discharge: 2.5–3%**.
- **Bystander CPR:** <10%; **public AED use:** <2%.

Contributing factors included limited CPR training among the public, lack of AED registration, and low dispatcher-assisted CPR rates. Pilot "Community First Responder" initiatives in Riyadh and Jeddah demonstrated improved ROSC (~10%) but remain limited in scale (Aljerian et al., 2024). Integration of AED networks into Asefny 3.0 (2024) is expected to enhance early defibrillation coverage.

3. Trauma and Road Traffic Injuries (RTIs)

RTIs accounted for nearly 70% of EMS trauma dispatches. National registry data showed male predominance (80%), mean age 29 years, and leading causes being vehicle collisions and rollovers. Despite efficient dispatch acceptance, prehospital mortality remained high (~15%), largely due to late scene arrival and lack of advanced airway or hemorrhage control procedures (Mahmud et al., 2022).

Studies called for implementation of paramedic-led advanced life support (ALS) and trauma bypass protocols to shorten transport times to trauma centers. Geriatric trauma was identified as an emerging burden with distinct triage needs and higher mortality (Harthi et al., 2024, 2025).

4. Digital Transformation and Access Innovations

Three studies documented the adoption and performance of digital health tools such as Asefny and Al-Mustajeeb apps (SRCA, 2025). The Asefny app expanded accessibility to individuals with hearing impairments and non-Arabic speakers through GPS location sharing and in-app translation.

Comparative analyses found slower median response (10–12 minutes) when calls were initiated via app versus 997 phone line (8 minutes), but better data completeness and accessibility metrics (Aljabri & Albinali, 2022). Integration of AI triage and e-hospital linkage (launched 2024) is projected to improve efficiency by 15–20%.

5. Workforce and Training

Qualitative interviews revealed staff shortages, fatigue, and variability in EMT competency levels (Alhamad et al., 2020). Studies emphasized the need for structured continuing professional development (CPD) and simulation-based EMS training. Moreover, paramedics cited barriers including limited clinical autonomy and lack of feedback mechanisms from receiving hospitals, impeding learning continuity and quality improvement (Harthi et al., 2025).

6. Public Awareness and Patient Perceptions

Surveys indicated moderate satisfaction (70–75%) with SRCA services but lower satisfaction in communication and waiting times. Public knowledge of EMS contact numbers improved to **~67%** by 2022, with strong preference for **mobile app-based requests** among younger users (Aljabri & Albinali, 2022). However, community education gaps persist, especially in rural regions.

Discussion

This systematic review highlights significant progress and persistent gaps in Saudi Arabia's prehospital emergency medical care system during the 2015–2025 decade.

1. Progress Aligned with Vision 2030

The Saudi Red Crescent Authority has achieved notable **digital modernization**, **expanded geographic coverage**, and **public accessibility** through Asefny and Al-Mustajeeb apps. These initiatives align with Vision 2030's objectives of enhancing efficiency, transparency, and patient-centered care. The observed improvement in call-to-dispatch times and increased national EMS coverage indicate structural advancement.

2. Ongoing Challenges in Response Efficiency and Clinical Outcomes

Despite these gains, median response times remain above international standards (≤8 minutes urban). Contributing factors include population density, traffic conditions, and uneven regional resource distribution. The

persistently low OHCA survival rates (<3%) underscore systemic gaps in early recognition, bystander intervention, and advanced field care capacity. Integrating public-access defibrillation, dispatcher-assisted CPR, and paramedic ALS expansion are urgent priorities.

3. Training and Workforce Development

Human resources remain a pivotal determinant of service quality. The transition from **technician-based to degree-qualified paramedics**, adoption of **simulation-based continuing education**, and establishment of **national EMS competency frameworks** are essential. Recent collaborations with the Saudi Commission for Health Specialties (SCFHS) and universities mark an encouraging trend, but uniform implementation remains incomplete.

4. Policy and Integration Needs

Fragmented data exchange between prehospital and hospital systems limits outcome tracking. The adoption of **integrated EMS–hospital dashboards** and **national registries (e.g., SOHAR)** must continue, ensuring linkage to morbidity and survival metrics. Furthermore, establishing **EMS research centers** within health clusters can institutionalize evidence generation and performance benchmarking.

5. Future Directions

Future priorities should include:

- Expansion of **AI-driven dispatch triage and predictive modeling** for high-demand zones.
- Strengthening **public training campaigns** for CPR/AED use.
- Integrating **tele-EMS consultations** for rural areas.
- Embedding **performance-based quality indicators** (e.g., response-time compliance, ROSC, satisfaction) into national EMS accreditation.

Conclusion

Between 2015 and 2025, Saudi Arabia's prehospital emergency medical care system has undergone substantial transformation under Vision 2030. While operational modernization and digital integration have improved access, significant challenges remain in response times, OHCA outcomes, trauma management, and workforce

competency. Coordinated policy, advanced clinical governance, and community engagement are critical for realizing world-class prehospital care in the next decade.

References

- Alabdali, A., Alghamdi, A., Binhotan, M., Alshibani, A., Alharbi, M., Alghaith, A., … Aljerian, N. (2024). Epidemiology and outcomes of out-of-hospital cardiac arrest in Saudi Arabia: Findings from the Saudi Out-of-Hospital Cardiac Arrest Registry (SOHAR). Resuscitation Plus, 17, 100516. https://doi.org/10.1016/j.resplu.2023.100516
- Aljabri, D., & Albinali, H. (2022). Public awareness and use of 997 emergency medical service phone number during the COVID-19 pandemic. *Frontiers in Public Health, 10*, 937202. https://doi.org/10.3389/fpubh.2022.937202
- Alslamah, T., Alsofayan, Y. M., Al Imam, M. H., Almazroa, M. A., Abalkhail, A., Alasqah, I., & Mahmud, I. (2023). Emergency medical service response time for road traffic accidents in Saudi Arabia: Analysis of national data (2016–2020). International Journal of Environmental Research and Public Health, 20(5), 3875. https://doi.org/10.3390/ijerph20053875
- Alsofayan, Y. M., Althunayyan, S. M., Mohamed, M. A., Alhabeeb, S. H., Altuwaijri, M. I., Alhajjaj, F. S., & Alowais, J. M. (2021). Out of hospital cardiac arrest: Saudi Red Crescent experience throughout COVID-19 era. Open Access Emergency Medicine, 13, 431–438. https://doi.org/10.2147/OAEM.S334808
- Harthi, N., Goodacre, S., & Sampson, F. C. (2024). The current status of trauma care for older adults in Saudi Arabia. Frontiers in Medicine, 11, 1505913. https://doi.org/10.3389/fmed.2024.1505913
- Harthi, N., Goodacre, S., Sampson, F. C., Binhotan, M., & Alotaibi, A. S. (2025). Paramedics and emergency medical technicians' perceptions of geriatric trauma care in Saudi Arabia. *BMC Emergency Medicine, 25*, Article 6. https://bmcemergmed.biomedcentral.com/articles/10.1186/s12873-024-01167-8
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ, 372*, n71. https://doi.org/10.1136/bmj.n71
- Saudi Red Crescent Authority (SRCA). (2025). *Home—Services and programs (Asefny, Al-Mustajeeb)*. https://srca.org.sa/en/ srca.org.sa
- Vision 2030. (2025). *Health Sector Transformation Program*. https://www.vision2030.gov.sa/en/explore/programs/health-sector-transformation-program