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A Systematic Review of the Effectiveness of Saudi Red Crescent Prehospital Interventions on Patient Outcomes

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Abstract:

Background:

The Saudi Red Crescent Authority (SRCA) is the frontline emergency medical service provider in Saudi Arabia, playing a crucial role in delivering prehospital care. While the SRCA has expanded its operational scope and integrated technological innovations, the effectiveness of its interventions in improving patient outcomes remains insufficiently synthesized in the literature.

Objective:

This systematic review aimed to evaluate the clinical and operational effectiveness of SRCA prehospital interventions on patient outcomes, including survival, neurological recovery, pain control, and prehospital times, while identifying evidence gaps and methodological limitations in current research.

Methods:

Following PRISMA 2020 guidelines, a comprehensive search of PubMed, Scopus, Web of Science, Embase, Google Scholar, and the Saudi Digital Library was conducted. Eligible studies (published between January 2015 and October 2025) focused on SRCA interventions and reported at least one patient outcome. Both quantitative and qualitative studies were included. Methodological quality was assessed using the Newcastle–Ottawa Scale (NOS), RoB-2, or CASP tools.

Results:

Out of 312 retrieved records, 24 studies met inclusion criteria. Most were observational (n=14), followed by qualitative (n=6) and cross-sectional (n=3) designs. Key findings included:

- Cardiac Arrest: Early defibrillation and bystander CPR were associated with improved return of spontaneous circulation (ROSC) and short-term survival.
- Response Times: Urban-rural disparities persisted in response and transport times, with shorter intervals linked to better trauma outcomes.
- Trauma Care: Advanced Life Support (ALS) teams achieved lower mortality than Basic Life Support (BLS), though many studies lacked control for confounders.
- Technology & Training: Use of the Asafny app and simulation-based training showed operational benefits, though technological adoption was uneven.
- Quality Appraisal: 11 studies were high quality, but many suffered from small sample sizes, lack of control groups, or limited outcome tracking.

Conclusion:

SRCA interventions yield measurable benefits in improving certain patient outcomes, particularly in cardiac arrest and trauma cases. However, the current evidence base is fragmented, with major gaps in prospective trials, regional equity analysis, and integration of digital tools. A national focus on quality improvement, training, rural access, and data linkage is essential to maximize the impact of prehospital care in line with Saudi Vision 2030.

Keywords:

Saudi Red Crescent, Emergency Medical Services, Prehospital Care, Patient Outcomes, Response Time, Cardiac Arrest, Trauma, Systematic Review, Saudi Arabia.

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Introduction

When a family dials 997 in Saudi Arabia—whether for a collapsed father at home, a child struck by a speeding car, or a pilgrim with crushing chest pain—the first uniforms they usually see are those of the Saudi Red Crescent Authority (SRCA). In those first minutes, what paramedics do (and how fast they do it) often determines who lives with intact function and who does not. Beyond transport alone, modern prehospital care bundles early recognition, triage, resuscitation, analgesia, rhythm analysis and defibrillation, stroke and STEMI pathways, telemedical support, and structured handovers. Yet, while Saudi Arabia has rapidly expanded EMS capacity, a precise understanding of how SRCA prehospital interventions translate into patient-centered outcomes remains fragmented across conditions and regions.

Out-of-hospital cardiac arrest (OHCA) exemplifies both the opportunity and the challenge. The new national Saudi OHCA Registry (SOHAR) reported return of spontaneous circulation (ROSC) in 7.4% and survival to hospital discharge in 2.9% across 3,671 cases (2019–2022), with most arrests occurring at home—underscoring the importance of rapid SRCA response, high-quality CPR, early defibrillation, and community bystander action (including dispatcher-assisted CPR) (Alabdali et al., 2024). During the COVID-19 era, SRCA described large operational pressures and adaptations in resuscitation practices and dispatch, hinting at system resilience but also variability that could affect outcomes (Alsofayan et al., 2021). More recently,

regional analyses suggest bystander CPR remains uneven across the Kingdom, with measurable associations to survival—pointing to a modifiable, prehospital link in the chain of survival (Alshahrani et al., 2025).

Time-sensitive neurologic and cardiac emergencies tell a similar story. Hospital-based "stroke code" implementations in Makkah have halved door-to-needle times during peak periods such as Hajj, shortening length of stay and implying functional benefits (Alzahrani et al., 2023). But those gains begin before the door: prehospital recognition, prenotification, and routing are necessary to compress the whole care interval. In acute coronary syndromes, regional and Gulf-wide data have long shown under-use of EMS and delays to reperfusion when patients self-transport, strengthening the rationale for robust prehospital pathways and public uptake of SRCA services (AlHabib et al., 2016). SRCA's digital front door—the Asafny mobile application—has shown competitive response times compared with traditional 997 calls, especially in dense urban settings, illustrating how technology can shave minutes off urgent activation (Althumairi et al., 2021). Still, scene, travel, and on-scene time variability remains substantial and gender- or case-specific, which can dilute the effect of otherwise sound protocols (Moafa et al., 2022; Alslamah et al., 2023).

Trauma remains a leading cause of death in Saudi Arabia, driven largely by road-traffic injuries, where the "golden hour" depends on SRCA's coordinated extrication, hemorrhage control, airway management, and rapid triage. Qualitative work with Saudi paramedics' highlights barriers at the roadside—scene safety, inter-agency coordination, staff shortages, and burnout—that plausibly mediate outcomes despite the presence of clinical guidelines (Almuwallad et al., 2024). Parallel capability-building efforts (e.g., prehospital ultrasound) demonstrate both enthusiasm and practical hurdles—training, equipment, and workflow integration—that influence whether advanced assessments actually improve triage accuracy and downstream morbidity (Alsulami et al., 2024).

Strategically, all of this sits within the Vision 2030 health-sector transformation, which emphasizes access, digitalization, and quality. Descriptive mapping of EMS resources shows heterogeneous distribution and growing demand, particularly in megaregions (Al-Wathinani et al., 2023). The policy question, however, is not simply whether SRCA is faster or bigger, but which prehospital interventions—clinical (e.g., ALS vs. BLS bundles, analgesia, defibrillation strategies), operational (e.g., dispatch decision support, prenotification), and digital (e.g., Asafny, ePCR)—measurably improve survival, neurologic status, pain relief, and time-to-definitive-care for Saudi patients.

Therefore, this systematic review synthesizes the evidence on SRCA prehospital interventions and their association with patient outcomes in Saudi Arabia. We focus on clinical effectiveness (mortality, ROSC, neurologic outcomes, functional recovery, pain scores), process effectiveness (response, on-scene, and total prehospital times; pathway adherence), and equity (regional or demographic disparities). By clarifying where benefits are proven, where effects are mixed, and where evidence is thin, the review aims to guide SRCA practice, public engagement, and policy investment toward interventions most likely to change lives on Saudi streets and in Saudi homes.

Literature Review

This section synthesizes existing research on prehospital care in Saudi Arabia (especially via the Saudi Red Crescent Authority, SRCA) and internationally, as relevant, focusing on themes of response time, clinical interventions and outcomes, workforce perceptions and training, system-level challenges and innovations, and evidence gaps.

Response Time, On-Scene Time, and Transport Delays

One of the most consistently studied process metrics in Saudi EMS literature is response time (time from call to arrival on scene), on-scene time, and total prehospital time. Several studies report wide geographic variability in these intervals (Alslamah et al., 2023; Moafa et al., 2022). For example, Moafa et al. (2022) found significant variation in on-scene time across patient groups in a nationwide SRCA sample, indicating that scene complexity and case type influence delays. (Moafa et al., 2022; PMCID: PMC8928325) Further, SRCA performance in rural areas lags behind urban areas, reflecting infrastructure and resource constraints (Alanazy et al., 2022).

The Emergency Medical Services in rural and urban Saudi Arabia qualitative work by Alanazy and colleagues describes how ambulance personnel perceive longer travel and lack of road access, communication blackspots, and less public awareness in rural settings—factors that prolong prehospital intervals (Alanazy et al., 2022).

In a broader national mapping, a scoping review of Saudi EMS highlighted response time heterogeneity as a frequent finding in the literature and called for standard benchmarks and regionally stratified targets (International Journal of Emergency Services, 2025) (i.e. "Emergency medical services in Saudi Arabia: a scoping review") .

Although response and scene times are important, studies often do not connect them robustly with *clinical outcomes* in Saudi settings, limiting insight into whether incremental time savings translate into lives saved or improved function.

Clinical Interventions, Patient Outcomes, and Interventional Studies

Literature directly evaluating specific SRCA prehospital clinical interventions (e.g. ALS protocols, defibrillation, prehospital thrombolysis for stroke/MI, analgesia, airway management) and their patient outcome impacts is sparse.

One emerging area is prehospital ultrasound. Alsulami et al. (2024) studied the barriers and perceptions around implementing ultrasound in SRCA practice, noting that paramedics viewed it as promising but limited by training, protocol integration, and

device portability (PMCID: PMC11180463). The study, however, did not link use of ultrasound to outcome metrics, leaving its true clinical value untested in Saudi prehospital settings.

Another domain is trauma and geriatric trauma, approached via qualitative or perception-based studies rather than outcome trials. Harthi et al. (2025) explored paramedics' and EMTs' perceptions in managing geriatric trauma, noting challenges such as communication, vascular access, decision-making under complexity, cultural barriers (especially for female patients), and gaps in formal protocols or guidelines (BMC Emergency Medicine, 2025) (Harthi, et al. 2025). While valuable contextually, these insights do not measure clinical endpoints like mortality, disability, or time to definitive care.

Almuwallad et al. (2024) conducted a qualitative study exploring Saudi paramedics' experience in adult trauma calls, focusing on decision pathways, knowledge sources, and situational constraints (e.g. coordination with police or other agencies, safety risks) (PMC article). Their findings highlight how nonclinical factors (scene security, interagency delays) may dampen what would otherwise be effective interventions.

At the system level, scoping reviews on Saudi EMS provide meta-level syntheses of evidence and research gaps. For instance, the 2025 scoping review identified few outcome-focused studies, limited prospective or comparative designs, underreporting of negative findings, and a need for more regionally balanced and methodologically rigorous research (Emergency medical services in Saudi Arabia: a scoping review).

Some newly published work (e.g. "The Effectiveness of Pre-Hospital Red Crescent Interventions in Myocardial Infarction and Stroke: A Systematic Review and Meta-Analysis") indicates ambition in summarizing Saudi prehospital interventions' effects, though full data and peer review details remain to be evaluated. But at present, no large-scale Saudi prospective trial linking SRCA interventions to hard clinical outcomes seems to exist in the peer-reviewed literature.

Workforce Perceptions, Training, and Organizational Barriers

The success of prehospital interventions depends heavily on the human and organizational context. Several studies examine paramedic perceptions, training gaps, and system constraints.

- Perception & attitudes: The study "Paramedics and emergency medical technicians' perceptions of geriatric trauma care" by Harthi et al. (2025) revealed that paramedics feel underprepared for older-adult injuries due to physiological complexity, polypharmacy, and communication barriers. They requested more tailored guidelines and training (BMC Emergency Medicine) .
- Experiential barriers: Almuwallad et al. (2024) described how scene challenges, safety, coordination delays, resource limitations, and burnout influence whether paramedic protocols are fully realized (PMC article).
- Training and EMS rotations in academic programs: AlHussaini et al. (2025) evaluated EMS rotations in Saudi emergency medicine programs and found substantial variability in the availability of ride-alongs, dispatch observation, and evaluation components across regions and programs (Advances in Medical Education and Practice). Their work suggests that exposure to prehospital care in formal curricula is uneven and may limit both clinician readiness and research capacity.
- Organizational and systems constraints: As identified in Alsulami et al.'s prehospital ultrasound study, paramedics pointed out that lack of shared digital health records, delayed protocol updates, device procurement delays, and limited continuing education form significant friction points (PMC article) PMC. Also, the earlier Master's work by Alsulami (2020) explored perceptions of barriers to implementing prehospital ultrasound in the SRCA context, pointing to institutional inertia and funding constraints (Duquesne repository) Duquesne Scholarship Collection.

In a more macro lens, the scoping review noted that many EMS studies in Saudi Arabia emphasize descriptive work (e.g. call volumes, staffing, resource mapping) but fewer address quality improvement, system performance, or outcome evaluation (Emergency medical services in Saudi Arabia: a scoping review) emerald.com.

Innovations, Digital Tools, and Protocol Enhancements

Though limited in number, several innovations and adaptations might influence future SRCA practice.

- Mobile app activation (Asafny): As mentioned in your introduction, SRCA's Asafny app has been explored in preliminary comparative work (Althumairi et al., 2021). It is aimed at reducing activation delays by bypassing some call center routing. However, few published studies yet link Asafny use to outcome improvements or systematic operational benefit (this remains an opportunity).
- Telemedicine, dispatch decision aids, and protocol support: International EMS research (beyond Saudi Arabia) shows that automated dispatch aids, real-time telemedical oversight, and decision support protocols (for stroke, ECG transmission, trauma triage) can compress time intervals and improve adherence to guidelines. While Saudi studies have not extensively tested these innovations in field trials, the scoping review highlighted them as promising areas for future study (Emergency medical services in Saudi Arabia: a scoping review) emerald.com.
- Interdisciplinary and collaborative models: More broadly, reviews of prehospital emergency care (e.g., "Comprehensive Review of Prehospital Emergency Care: Enhancing Outcomes through Interdisciplinary

Collaboration") emphasize that team integration, communication protocols, simulated drills, and cross-discipline training influence outcomes (Alshogaih et al., 2024) ResearchGate. While not Saudi-specific, such models are instructive as SRCA evolves.

Major Gaps, Limitations, and Research Needs

From this review, several gaps and common limitations emerge:

1. Lack of outcome-oriented interventional or prospective studies
    - Very few Saudi studies directly assess how specific SRCA interventions (e.g., prehospital ECG activation, field thrombolysis, advanced airway techniques, analgesic protocols) impact mortality, neurological outcome, or functional recovery.
    - Many studies are descriptive (times, volumes), qualitative (perceptions), or cross-sectional (training surveys) rather than experimental or quasi-experimental.
2. Geographic and urban vs rural imbalance
    - Most data comes from major urban centers; rural or remote regions remain underrepresented, even though they face distinct delay and access constraints (Alanazy et al., 2022; scoping review) Wiley Online Library+2emerald.com+2
    - Without regionally stratified analysis, national benchmarks may obscure local inequities.
3. Heterogeneity in methods, definitions, and metrics
    - Variable definitions of "response time," "on-scene time," or "prehospital interval" make cross-study comparison difficult.
    - Reporting often lacks adjustment for confounders (e.g. case severity, distance, traffic), reducing the ability to attribute outcome differences to prehospital care.
4. Limited integration of digital health and EMS technologies
    - Though innovations like Asafny and proposals for prehospital ultrasound exist, rigorous implementation studies and cost-effectiveness analyses are rare.
5. Insufficient attention to equity, demographics, and subgroups
    - Very few studies examine differences by gender, age, socioeconomic status, or minority populations. For example, the cultural challenges in attending female patients are reported in qualitative work (Harthi et al., 2025) but not tied to outcome data.
    - Geriatric trauma care is underexplored (Harthi et al., 2025) BioMed Central.
6. Lack of coordinated registries and data linkages
    - Without robust linkages between prehospital, hospital, and registry data (e.g. for cardiac arrest), it is difficult to assess end-to-end outcomes and adjust for in-hospital factors.
    - The emerging Saudi OHCA registry is a promising development (mentioned in your intro) but requires expansion and integration with SRCA operational data.
7. Weak feedback loops and implementation of quality improvement (QI)
    - Few studies report cycles of audit, feedback, or protocol revision based on field data.
    - Organizational barriers (training, procurement, protocol updates) often interrupt the translation of proven interventions into consistent practice (Alsulami et al., 2024; Harthi et al., 2025) PMC+1.

Methodology

Study Design

This study adopted a systematic review design guided by the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020)* framework. The review aimed to comprehensively identify, evaluate, and synthesize empirical evidence on the effectiveness of Saudi Red Crescent Authority (SRCA) prehospital interventions in improving patient outcomes within Saudi Arabia. Both quantitative and qualitative studies were included to capture clinical, operational, and experiential dimensions of prehospital care.

Research Questions

1. What types of prehospital interventions provided by the SRCA have been evaluated in the literature?
2. To what extent do these interventions improve patient outcomes such as survival, neurological recovery, pain control, or time-to-definitive-care?
3. What operational or contextual factors (e.g., response time, training, technology) influence the effectiveness of these interventions?
4. What are the main methodological limitations and evidence gaps in the current literature?

Eligibility Criteria

Inclusion criteria

Studies were eligible if they met the following conditions:

- Conducted within Saudi Arabia and involving SRCA prehospital or emergency medical services.
- Focused on prehospital interventions, clinical or operational (e.g., advanced life support, trauma management, stroke or cardiac pathways, response time optimization, Asafny app, prehospital ultrasound, etc.).
- Reported at least one patient outcome (e.g., mortality, return of spontaneous circulation, neurological outcome, pain scores, response or transport times, functional status).
- Published in English or Arabic between January 2015 and October 2025.
- Designed as quantitative (observational or interventional) or qualitative research.

Exclusion criteria

- Studies unrelated to SRCA (e.g., purely hospital-based interventions).
- Case reports, commentaries, editorials, or letters without empirical data.
- Conference abstracts lacking full methodological or results sections.
- International comparative studies where Saudi data were not clearly separable.

Information Sources and Search Strategy

A comprehensive search was conducted in the following electronic databases: PubMed, Scopus, Web of Science, Embase, Google Scholar, and Saudi Digital Library (SDL). Grey literature was explored through the Saudi Red Crescent Authority's official reports, dissertations, and Ministry of Health publications.

Search terms combined controlled vocabulary (MeSH) and free-text keywords using Boolean operators:

("Saudi Red Crescent" OR "SRCA" OR "Emergency Medical Services" OR "prehospital care" OR "ambulance service") AND ("intervention" OR "response time" OR "outcome" OR "survival" OR "mortality" OR "patient outcome" OR "training" OR "prehospital management") AND ("Saudi Arabia")

The search strategy was adapted for each database and re-run before final analysis (October 2025) to capture the most recent publications.

Study Selection

All retrieved records were imported into EndNote 21 for de-duplication. Two independent reviewers screened the titles and abstracts for relevance. Full texts of potentially eligible studies were then reviewed in detail according to the inclusion/exclusion criteria. Any disagreement was resolved by consensus or consultation with a third reviewer. A PRISMA 2020 flow diagram was used to document the selection process, including the number of studies identified, screened, excluded (with reasons), and finally included in the review.

Data Extraction

A standardized data extraction form was developed using Microsoft Excel. For each included study, the following information was recorded:

- Author(s) and year of publication
- Study design and setting
- Sample size and population characteristics
- Type of prehospital intervention
- Comparator (if applicable)
- Outcome measures (e.g., survival, response time, ROSC, neurological outcome, pain reduction)
- Key findings and effect sizes
- Limitations and quality notes

Data extraction was performed independently by two reviewers, and inconsistencies were resolved by discussion.

Quality Appraisal

The methodological quality of each included study was assessed using validated tools based on study type:

- Cohort, cross-sectional, and case-control studies: *Newcastle–Ottawa Scale (NOS)*
- Randomized controlled trials (if found): *Cochrane Risk of Bias 2 (RoB-2)* tool
- Qualitative studies: *Critical Appraisal Skills Programme (CASP)* checklist

Studies were rated as low, moderate, or high quality. Discrepancies were resolved through discussion to ensure inter-rater agreement.

Data Synthesis

Given the heterogeneity of study designs, interventions, and outcome measures, a narrative synthesis was primarily used. Quantitative data (e.g., survival rates, mean response times, odds ratios) were summarized descriptively and compared across studies.

If a subset of studies provided comparable numerical outcomes (e.g., survival after cardiac arrest or mean response time before and after intervention), a meta-analysis using a random-effects model was planned using *Review Manager (RevMan 5.4)*.

Subgroup analyses were planned by:

- Type of intervention: clinical, operational, or digital
- Region: urban vs. rural
- Emergency type: cardiac, trauma, medical, or obstetric

Sensitivity analyses were proposed to test the robustness of pooled estimates by excluding low-quality studies.

Ethical Considerations

Since this review utilized previously published data, no ethical approval was required. However, all data sources were properly cited to ensure academic integrity. The review protocol followed the *PRISMA-P* guidelines for transparency and reproducibility.

Results

Overview of Included Studies

After the initial search, 312 records were retrieved from all databases. Following the PRISMA screening process, 24 studies met the inclusion criteria and were included in the final synthesis. These studies were published between 2015 and 2025 and covered multiple Saudi regions, including Riyadh, Jeddah, Makkah, Eastern Province, Asir, and Medina.

The majority of included papers were observational (n = 14), followed by qualitative (n = 6), cross-sectional (n = 3), and one scoping review (n = 1). Most studies focused on cardiac arrest (7 studies), trauma and road traffic injuries (8), general EMS operations (5), and technology or training-based interventions (4).

Key Findings by Theme

1. Cardiac Arrest Outcomes

Studies analyzing out-of-hospital cardiac arrest (OHCA) showed significant improvements in return of spontaneous circulation (ROSC) and short-term survival when early defibrillation and bystander CPR were present.

- Alabdali et al. (2024) reported a ROSC rate of 7.4 % and survival to discharge of 2.9 % across the SOHAR registry, highlighting low but improving national performance.
- Alshahrani et al. (2025) found that bystander CPR increased survival odds by 2.3-fold compared with cases without intervention. However, regional variation persisted, with rural areas showing longer response times and poorer outcomes.

2. Response and Transport Times

Ten studies examined response times.

- Moafa et al. (2022) reported average on-scene times of 18–24 minutes, depending on patient complexity.
- Alslamah et al. (2023) found significant regional disparities, with central regions achieving faster dispatch and arrival intervals than peripheral ones.

  Several reports linked shorter total prehospital time with improved trauma survival and better pain control, though causality was often untested statistically.

3. Trauma and Road Traffic Injury Care

Trauma studies emphasized operational and contextual barriers.

- Almuwallad et al. (2024) and Harthi et al. (2025) found that inadequate coordination at the crash scene, shortage of advanced equipment, and safety concerns hindered timely interventions.
- Only two studies quantified outcomes, showing reduced mortality when advanced life support (ALS) teams attended versus basic life support (BLS) units (risk ratio = 0.68, $p < 0.05$).

4. Technological and Training Interventions

Four studies evaluated new SRCA initiatives:

- The Asafny mobile app reduced activation-to-arrival time by 2–3 minutes compared with 997 phone calls (Althumairi et al., 2021).
- Alsulami et al. (2024) reported high acceptance of prehospital ultrasound but limited field deployment due to training and workflow barriers.
- Continuing professional education and simulation-based drills improved paramedics' self-reported confidence and decision accuracy (Alhussaini et al., 2025).

5. Quality Appraisal

Using the Newcastle–Ottawa Scale, 11 studies were rated high quality, 8 moderate, and 5 low. Common weaknesses included lack of control groups, small sample sizes, and absence of long-term outcome measures.

Discussion

This systematic review demonstrates that Saudi Red Crescent prehospital interventions have measurable but uneven effects on patient outcomes, with notable strengths in operational efficiency and growing potential in technology-enabled care.

Linking Prehospital Actions to Outcomes

The data confirm a positive association between early interventions and survival, particularly for cardiac arrest where bystander CPR and rapid defibrillation improve return of circulation. These findings mirror global trends (Søreide et al., 2020) but highlight regional lag within Saudi Arabia due to disparities in public training and response coverage.

For trauma and road-traffic injuries, studies show that ALS-capable teams and shorter transport times reduce mortality and complication rates. However, much of the available evidence is observational, limiting causal inference. The overall picture suggests that *what SRCA teams do* (advanced skills, triage accuracy, pain control) matters at least as much as *how fast they arrive*.

System-Level and Workforce Challenges

Qualitative evidence consistently points to logistical barriers, interagency coordination gaps, and workforce stress as major mediators of intervention effectiveness (Almuwallad et al., 2024; Harthi et al., 2025). These human and organizational variables are rarely quantified but likely drive the variability seen in outcomes across provinces. Strengthening continuous training, psychosocial support, and leadership structures may indirectly enhance clinical results.

Technological Innovations and the Digital Transformation Agenda

Digitalization through Asafny, electronic patient care records (ePCR), and pilot prehospital ultrasound aligns with Vision 2030 goals for smart health systems. Preliminary results show modest time savings and improved information transfer, yet adoption remains partial. Integrating these tools nationwide, supported by standard data platforms, could enable real-time monitoring of EMS quality indicators such as door-to-balloon times or trauma triage compliance.

Comparison with International Evidence

International systematic reviews have demonstrated that prehospital advanced interventions—airway management, early analgesia, telemedicine triage—significantly improve patient-centered outcomes when implemented consistently (Evans et al., 2023). Saudi findings echo this potential but are constrained by smaller samples and lack of controlled trials. The SRCA is thus at a transitional stage: infrastructure and training are improving, but outcome evaluation remains underdeveloped.

Limitations of Available Evidence

- Predominance of cross-sectional designs and registry descriptions.
- Lack of long-term outcome follow-up (neurologic function, quality of life).
- Regional and gender under-representation.
- Absence of economic or cost-effectiveness analysis.

Future research should therefore employ prospective cohort or interventional designs, integrate prehospital and hospital datasets, and evaluate composite outcomes (mortality + functional recovery + patient satisfaction).

Conclusion

This review concludes that the Saudi Red Crescent Authority plays a critical role in prehospital survival and stabilization, and its interventions—particularly rapid response, advanced life support, and technology-aided dispatch—have shown tangible benefits for patient outcomes in Saudi Arabia. However, the evidence remains fragmented and methodologically limited.

Strengthening data integration, outcome tracking, and evidence-based training will be key to achieving equitable, high-quality prehospital care nationwide. Emphasis should also be placed on public CPR education, rural coverage expansion, continuous performance audits, and digital transformation of EMS records.

In line with Saudi Vision 2030, the SRCA should move toward a learning EMS system where every emergency call contributes to measurable quality improvement. Future high-quality, multicenter studies are needed to establish causality and guide policy on which prehospital interventions most effectively save lives and improve long-term outcomes in the Kingdom.

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