

REVIEW ARTICLE

Mapping the evidence on emergency medical services and disaster preparedness in Saudi Arabia: a scoping review

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ABSTRACT

Saudi Arabia has rapidly expanded and modernized its Emergency Medical Services (EMS), but the published evidence relevant to disaster preparedness is heterogeneous and spans direct preparedness research, EMS system-development studies, and contextual workforce evidence. This scoping review mapped these distinct evidence streams and identified gaps in disaster-specific readiness, education, coordination, workforce support, and resource distribution. The review followed Joanna Briggs Institute guidance and was reported in accordance with PRISMA-ScR. Databases were searched from inception to May 2026. Eligible publications addressed EMS system development, disaster or major-incident preparedness and response, or workforce, educational, organizational, resource, and technological factors relevant to emergency response capacity in the Saudi context. Evidence was charted by design, population, or unit of analysis, topic, and degree of relevance to disaster preparedness, then synthesized narratively. A total of 22 studies met the inclusion criteria. Evidence clustered into four domains: EMS system development and healthcare transformation; disaster preparedness and response challenges; education, training, and workforce competency; and ethical and professional challenges. The literature documented substantial progress in infrastructure, technology, and workforce development, while repeatedly identifying gaps in disaster-specific training, simulation exposure, interagency coordination, resource distribution, leadership competencies, and role clarity during mass-casualty incidents. The Saudi literature contains a relatively small body of direct evidence on EMS disaster preparedness alongside a broader literature on EMS development and workforce factors that might shape preparedness capacity. The review mapped these evidence streams rather than rating national preparedness and identified priorities for standardized measurement, simulation-based education, interagency evaluation, and longitudinal research.

Keywords: Emergency medical services, disaster preparedness, prehospital care, Saudi Arabia, scoping review, workforce readiness.

Introduction

Modern healthcare systems recognize emergency medical services (EMS) as a key component of healthcare delivery and often serve as the first point of medical contact during emergencies and disasters. The primary aim of EMS systems is to provide rapid assessment, stabilization, treatment, and transportation for patients experiencing acute illness or injury to minimize preventable mortality and long-term disability [1]. EMS is not limited to ambulance transport; it includes a coordinated network of dispatch centers, communication systems, EMS personnel, emergency vehicles, receiving hospitals, and medical oversight working together to ensure immediate emergency care. In disaster situations, EMS systems play a critical role in triage, evacuation planning, on-scene coordination, and the management of

mass-casualty incidents. The effectiveness of emergency and trauma systems has been linked to improved patient outcomes, particularly when coordination occurs between prehospital care, hospital services, rehabilitation, and healthcare governance [2].

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50	Over the past two decades, the EMS system in Saudi	110
51	Arabia has undergone substantial development and	111
52	become an essential component of the healthcare sector.	
53	In 1963, the Saudi Red Crescent Authority (SRCA)	
54	was established as the primary provider of prehospital	
55	emergency services across the Kingdom, operating in	
56	both urban and rural areas. Furthermore, the Saudi EMS	
57	system largely follows the Anglo-American model, in	
58	which paramedics and Emergency Medical Technicians	
59	(EMTs) provide rapid stabilization and transportation	
60	of patients to hospitals for definitive care [3]. As the	
61	population continues to grow, urban areas expand,	
62	and mass gatherings become more frequent, the need	
63	for a strong and well-prepared emergency care system	
64	becomes increasingly important.	
65	Despite notable progress, several challenges remain,	
66	including low public engagement with ambulance	
67	services, inadequate research infrastructure, and	
68	inconsistencies in system evaluation and preparedness. To	
69	address these challenges, the government has supported	
70	the advancement of EMS through educational reforms,	
71	workforce development, and the transition from a limited	
72	first-aid model to a professional healthcare discipline	
73	supported by university-level education and bachelor's	
74	degree programs. These developments demonstrated	
75	meaningful progress in strengthening the national	
76	EMS framework; however, further improvements are	
77	still needed to enhance disaster readiness and integrate	
78	emergency response efforts effectively [4].	
79	In accordance with Saudi Vision 2030, Saudi Arabia has	
80	placed increasing emphasis on healthcare transformation	
81	and emergency preparedness. Trauma remains a major	
82	public health concern in the Kingdom due to road traffic	
83	accidents and large-scale incidents. In response, Saudi	
84	Arabia has focused on developing trauma systems to	
85	establish more coordinated and efficient emergency	
86	response structures [5]. Recognizing the need for stronger	
87	coordination between EMS providers, trauma centers,	
88	rehabilitation services, and healthcare administration,	
89	the country has initiated the development of a national	
90	trauma system aimed at improving trauma response and	
91	patient outcomes [6].	
92	At the workforce level, the role of paramedics has	
93	expanded considerably, with increasing involvement	
94	in advanced prehospital critical care, disaster response,	
95	and community health initiatives. In addition, healthcare	
96	transformation efforts have focused on improving	
97	infrastructure, workforce capacity, and the integration	
98	of modern technologies to strengthen emergency	
99	response capabilities across the Kingdom [5]. As part	
100	of these developments, Helicopter Emergency Medical	
101	Services (HEMS) have become increasingly important	
102	in supporting rapid transportation and improving access	
103	to specialized trauma care during critical emergencies	
104	and disasters, particularly in remote areas where access	
105	to trauma centers may be limited [7]. Similarly, drone-	
106	supported emergency response systems have shown	
107	potential to improve disaster management efficiency	
108	and reduce response times in remote or difficult-to-	
109	access areas, highlighting the growing importance of	
	technological innovation in emergency preparedness and	110
	disaster response [8].	111
	Despite substantial development of EMS in Saudi Arabia,	112
	the published literature spans several distinct but related	113
	areas, including EMS system development, disaster	114
	preparedness, education, workforce readiness, and	115
	operational coordination. These evidence streams have	116
	not been mapped together in a way that distinguishes	117
	direct preparedness research from broader system and	118
	workforce evidence. This scoping review therefore	119
	aimed to map the Saudi literature on EMS and disaster	120
	preparedness, characterize the types of evidence available,	121
	and identify gaps across preparedness, education,	122
	coordination, workforce, and resource domains.	123
	Subjects and Methods	124
	<i>Study design</i>	125
	This scoping review mapped the breadth, characteristics,	126
	and gaps of published evidence on emergency medical	127
	services and disaster preparedness in Saudi Arabia. The	128
	review was reported in accordance with the Preferred	129
	Reporting Items for Systematic Reviews and Meta-	130
	Analyses extension for Scoping Reviews (PRISMA-	131
	ScR) [9] and followed updated Joanna Briggs Institute	132
	(JBI) methodological guidance [10]. A scoping approach	133
	was selected because the evidence base includes	134
	heterogeneous empirical studies, reviews, educational	135
	reports, and system-development publications that	136
	differ in their degree of direct relevance to disaster	137
	preparedness.	138
	<i>Review question and PCC framework</i>	139
	The review question and eligibility criteria were	140
	structured using the Population, Concept, Context	141
	(PCC) framework recommended for scoping reviews	142
	[10]. The population was defined broadly to include	143
	EMS and emergency-care personnel, services, systems,	144
	organizations, educational programs, and workforce	145
	structures. The concept encompassed EMS system	146
	development and disaster preparedness and response,	147
	including organizational, educational, workforce,	148
	resource, technological, and professional factors relevant	149
	to emergency response capacity. The context was Saudi	150
	Arabia. The review question was: What evidence exists on	151
	emergency medical services and disaster preparedness in	152
	Saudi Arabia, and what gaps are identified across system,	153
	organizational, educational, workforce, and professional	154
	domains? (Table 1).	155
	<i>Search strategy</i>	156
	A literature search was conducted in PubMed, Scopus,	157
	and Web of Science from database inception to May	158
	2026. Search concepts covered Emergency Medical	159
	Services (EMS), emergency care, prehospital care,	160
	paramedics, disaster preparedness, disaster response,	161
	emergency management, system development, and Saudi	162
	Arabia. Controlled vocabulary and free-text terms were	163
	combined with Boolean operators as appropriate to each	164
	database. Because the original database search-history	165

166 exports were no longer available at the time of revision,
 167 database-specific search strategies were reconstructed
 168 from the search concepts. Reference lists of eligible
 169 publications were also screened for additional records
 170 (Table 2).

171 **Study selection**

172 The study selection process was conducted independently
 173 by two reviewers according to the predefined inclusion
 174 and exclusion criteria. Titles and abstracts were initially
 175 screened for relevance, followed by full-text assessment
 176 of potentially eligible studies. Any disagreements
 177 regarding study eligibility were resolved through
 178 discussion and consensus between the reviewers. The
 179 complete study selection process was carried out using
 180 the PRISMA 2020 guidelines [11].

181 **Data extraction**

182 Data were charted using a standardized form capturing
 183 citation, publication year, setting, study or publication
 184 design, population or unit of analysis, principal findings,
 185 and relevance to disaster preparedness. Because the
 186 included literature varied substantially in purpose and
 187 design, publications were classified by evidentiary
 188 role: (1) direct disaster-preparedness evidence, when
 189 disaster or mass-casualty preparedness was explicitly
 190 assessed or evaluated; (2) EMS-system-development
 191 evidence, when the publication addressed organization,
 192 workforce distribution, education, technology,
 193 resources, or service development with relevance to
 194 response capacity; or (3) indirect/contextual workforce
 195 evidence, when professional or psychological factors
 196 relevant to responder capacity were examined without
 197 directly measuring disaster preparedness. Study-level
 198 descriptions were checked against the source publication
 199 and phrased to avoid extending conclusions beyond the
 200 original study (Tables 3-6).

Quality assessment

Consistent with the JBI methodology for scoping
 reviews, a formal critical appraisal of study quality was
 not conducted, as the primary aim of this review was to
 map the available evidence and identify research gaps
 rather than evaluate the effectiveness of interventions.

Synthesis of data

Extracted findings were synthesized narratively.
 The primary synthesis distinguished direct disaster-
 preparedness evidence from EMS-system-development
 evidence and indirect/contextual workforce evidence.
 Within these evidence levels, recurring findings were
 organized into four descriptive domains: (1) EMS system
 development and healthcare transformation; (2) disaster
 preparedness and response; (3) education, training,
 and workforce competency; and (4) professional and
 workforce context. This structure allowed broader system
 and workforce publications to inform interpretation
 without presenting them as direct measurements of
 disaster readiness.

Results

The database search identified 256 records. After removal
 of 40 duplicates, 216 records underwent title and abstract
 screening; 66 articles proceeded to full-text assessment,
 and 22 met the eligibility criteria and were included in
 the final synthesis (Figure 1).

The literature included was heterogeneous in design and
 scope. It comprised empirical studies of EMS personnel,
 educational and workforce studies, reviews and
 system-development publications, and a smaller set of
 multidisciplinary disaster-education studies. Importantly,
 not all publications directly measured disaster
 preparedness. The synthesis therefore distinguished
 direct preparedness evidence from system-development
 and indirect/contextual evidence rather than treating

Table 1. Eligibility criteria based on the PCC framework.

PCC element	Description
Population	EMS and emergency-care personnel, services, systems, organizations, educational programs, and workforce structures.
Concept	EMS system development and disaster preparedness and response, including organizational, educational, workforce, resource, technological, and professional factors relevant to emergency response capacity.
Context	Saudi Arabia and the Saudi emergency-care context.

Table 2. Inclusion and exclusion criteria for the study inclusion in the scoping review.

Inclusion criteria	Exclusion criteria
Saudi publications addressing EMS or emergency-care personnel, services, systems, education, workforce, or organization.	Publications with no identifiable relevance to EMS, emergency care, or emergency response capacity in the Saudi context.
Publications addressing disaster or major-incident preparedness/response OR EMS-system factors with explicit relevance to emergency response capacity.	General healthcare or professional topics without a clear connection to EMS, emergency care, disaster/major-incident preparedness, or emergency response capacity.
Empirical studies, reviews, educational studies, and system-development publications.	Publications conducted exclusively outside Saudi Arabia without relevant Saudi-specific evidence.
English-language, peer-reviewed publications with accessible full text.	Non-English publications, duplicates, unavailable full text, or records for which eligibility could not be established from the full article.

238 **Table 3.** EMS system development and healthcare transformation.

Author	Year of study	Study location	Study Type	Population/unit of analysis	Findings
Al-Naami et al. [2]	2010	Saudi Arabia	Narrative review / perspective review	Not applicable	Highlighted the importance of organized trauma systems, coordinated emergency care pathways, and integration between prehospital and hospital services to improve trauma outcomes in Saudi Arabia.
Al Mutairi et al. [3]	2016	Saudi Arabia	Narrative review / descriptive review	Not applicable	The study reviewed the Emergency Medical Service (EMS) system in Saudi Arabia, including system structure, dispatch services, workforce issues, response challenges, and ongoing efforts to improve prehospital emergency care services across the Kingdom.
Chowdhury et al. [6]	2022	Saudi Arabia	System-development / implementation article	Not applicable	Described the design and implementation of the Saudi trauma system, including coordinated trauma pathways and system standards. Relevant to emergency-system development.
Alotaibi et al. [5]	2025	Saudi Arabia	Review article / descriptive analysis	Not applicable	Vision 2030 has accelerated the modernization of EMS systems in Saudi Arabia through workforce development, technological integration, and expansion of paramedic roles.
Alqahtani et al. [7]	2025	Saudi Arabia	Retrospective cohort study	600 critically ill or injured patients transported by air or ground ambulance (2020-2023)	Air ambulance transport was associated with lower mortality and improved survival compared with ground transport, highlighting the expansion and development of aeromedical capabilities within the Saudi EMS system.
Hertelendy et al. [8]	2023	Saudi Arabia	Letter to the editor	Not applicable	Drone integration was identified as an emerging opportunity to advance Saudi prehospital and disaster care, particularly for search and rescue, medical supply delivery, and remote monitoring, supporting broader health-sector transformation.
Alanezy et al. [13]	2025	Saudi Arabia	Systematic review	Published literature on paramedics and EMS within the Saudi emergency care system	Reported progress in prehospital response capabilities, paramedic education, and technological integration, while identifying persistent challenges in workforce distribution, gender inclusion, and continuing professional development.

239 **Table 4.** Disaster preparedness and response challenges.

Author	Year of study	Study location	Study type	Population/unit of analysis	Findings
Al Balhareth et al. [15]	2024	Saudi Arabia	Narrative review / descriptive paper	Not applicable (EMS and paramedic focus)	Reviewed the role and readiness requirements of EMS and paramedics in crisis and disaster management, including training, coordination, resources, and technology. It provides a preparedness-focused synthesis.
Alazmy [16]	2025	Saudi Arabia	Cross-sectional quantitative study	Saudi paramedics working in SRCA ambulance stations	Reported moderate disaster preparedness among paramedics, with gaps in roles understanding, leadership skills, and disaster response competencies. Recommended enhanced training, mock drills, and preparedness education.
Almukhlifi et al. [23]	2024	Saudi Arabia	Descriptive cross-sectional study	EMS personnel	Reported moderate levels of disaster knowledge, skills, and preparedness among EMS workers, while emphasizing the need for additional disaster education, training, and preparedness investment.
Alanazy et al. [14]	2021	Saudi Arabia	Qualitative study	Frontline EMS personnel in rural and urban Saudi settings	Examined organizational factors affecting rural and urban EMS performance. The findings provide organizational context relevant to response capacity rather than a direct measure of disaster preparedness.
Al-Wathinani et al. [17]	2023	Saudi Arabia	Cross-sectional	Saudi EMS workforce and national distribution data	Examined the characteristics and geographic distribution of the Saudi EMS workforce and identified distribution gaps. The study discusses implications for routine demand and disasters.
AlShammari et al. [4]	2017	Saudi Arabia	Narrative review	Not applicable	Described the evolution of EMS in Saudi Arabia. Classified as EMS-system-development evidence.

240 **Table 5. Education, training, and workforce competency.**

Author	Year of study	Study location	Study type	Population/unit of analysis	Findings
Bajow et al. [19]	2015	Saudi Arabia	Cross-sectional survey	Saudi medical schools (20 responding schools)	Assessed disaster-medicine education in Saudi medical schools. Three of 20 responding schools reported disaster-medicine programs, indicating limited formal undergraduate disaster-medicine provision. This is direct disaster-education evidence but is not EMS-specific.
Bajow et al. [20]	2018	Saudi Arabia	Educational intervention (pre-post course evaluation)	29 multidisciplinary healthcare providers in Riyadh	Evaluated a four-day course in prehospital major-incident management. Mean knowledge scores increased from 55.1% before training to 68.4% after training ($p < 0.05$). This is direct disaster-education evidence in a multidisciplinary group.
Alamri [21]	2017	Saudi Arabia	Letter to the Editor	Not applicable	Described the history and challenges of emergency medical technician education in Saudi Arabia. This is an EMS education and system-development context rather than direct disaster-preparedness evidence.
Althagafi et al. [22]	2025	Saudi Arabia	Descriptive analytical study	Paramedic education programs in Saudi universities	Examined future qualification needs and gaps between theoretical and practical paramedic education, including training resources and simulation.
Alanazi [18]	2012	Saudi Arabia	Descriptive educational curriculum paper / Program development study	Not applicable	Described the development of a competency-based EMS curriculum at KSAU-HS and highlighted the role of structured EMS education in strengthening the Saudi paramedic workforce and supporting EMS system development.

241 **Table 6. Indirect/contextual professional and workforce evidence.**

Author	Year of study	Study location	Study type	Population/unit of analysis	Findings
Almutairi et al. [26]	2020	Saudi Arabia	Cross-sectional questionnaire study	300 SRCA paramedics from 21 stations in Riyadh	Measured depression, anxiety, and stress symptoms among SRCA paramedics. The study informs workforce well-being and responder capacity.
Alshamrani et al. [28]	2024	Saudi Arabia	Mixed methods	Saudi paramedics responding to traumatic events	Mixed-methods study of distress among Saudi paramedics following traumatic events. Contextual workforce evidence.
Alanazi et al. [27]	2025	Saudi Arabia	Cross-sectional study	409 frontline SRCA paramedics across Saudi regions	Assessed PTSD prevalence and determinants among frontline SRCA paramedics. The study provides contextual evidence on responder psychological well-being.
Qudus et al. [25]	2025	Saudi Arabia	Descriptive Review	Not applicable	Discussed professional responsibilities and occupational/organizational challenges of SRCA paramedics. Contextual professional evidence

242 all included publications as equivalent indicators of
243 readiness.

244 Across the evidence base, direct preparedness studies
245 were concentrated on knowledge, skills, roles, training,
246 and mass-casualty readiness. System-development
247 publications addressed EMS organization, trauma
248 systems, workforce distribution, education, and emerging
249 technologies, while contextual workforce studies
250 addressed occupational and psychological factors. The
251 sections below retain these distinctions when interpreting
252 the evidence.

253 Across the included literature, preparedness was
254 shaped by more than individual knowledge or training.
255 System organization, workforce distribution, education,
256 equipment and technology, interagency coordination, and
257 professional support repeatedly appeared as conditions
258 that could strengthen or constrain emergency response
259 capacity. These factors were therefore interpreted as

contextual or system-level evidence unless preparedness
was measured directly.

EMS system development and healthcare transformation

Saudi EMS has expanded within a multi-sector healthcare system [12]. It has undergone marked professional and technological development, particularly in the context of Vision 2030 [5,13]. The Saudi Red Crescent Authority remained the principal national prehospital provider, and the system predominantly follows an Anglo-American model in which EMTs and paramedics provided out-of-hospital assessment, stabilization, treatment, and transport [3].

The literature described a transition from a basic first-aid model toward university-based paramedic education and advanced prehospital practice. However, system-level challenges remain, including limited public utilization

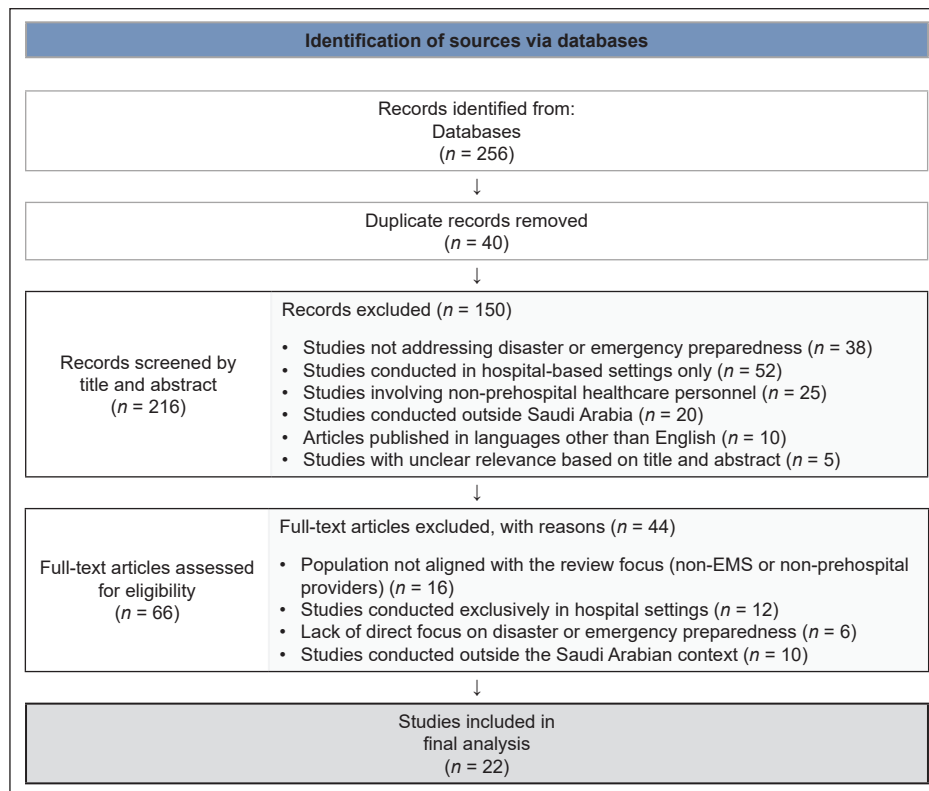


Figure 1. PRISMA flow diagram of study selection.

of ambulance services, gaps in EMS research capacity and data quality, and limited postgraduate development opportunities [4].

Trauma-system development, HEMS, and emerging technologies such as unmanned aerial vehicles illustrated continued modernization of emergency care and the potential to improve access and response in remote or difficult-to-reach settings [2,7,8]. Collectively, these studies documented substantial system growth but provided less direct evidence on whether modernization has translated into standardized disaster preparedness capability.

Disaster preparedness and response challenges

Preparedness studies identified operational and organizational barriers that might affect disaster response, including traffic-related delays, scene interference, limited administrative support, communication challenges, responder-safety concerns, shortages of protective equipment or supplies, and variable intersectoral coordination [14,15].

Direct assessment of Saudi paramedics reported moderate preparedness for mass-casualty incidents and limited participation in disaster planning and simulation. Reported gaps included leadership capability, role comprehension, disaster-response skills, and practical exposure, supporting the need for structured simulation and competency-based preparedness training [16].

Resource distribution was another recurring concern. Differences in workforce and resource availability between rural and urban settings might contribute to

delayed response and unequal access to EMS. The literature therefore linked preparedness not only to individual competency but also to workforce planning, hospital-EMS coordination, and equitable deployment of emergency resources [14,17].

Education, training, and workforce competency

Education and workforce development emerged as a consistent preparedness theme. Saudi EMS education has expanded substantially through university-based programs designed to strengthen the national paramedic workforce [18]. Nevertheless, studies reported limited formal disaster-medicine education and gaps in core competencies such as incident command, disaster triage, and mass-casualty care [19,20].

Reported educational barriers included limited simulation resources, restricted opportunities for practical training, variable trainee confidence, and the need for curricula to remain aligned with evolving emergency standards [21,22]. Included studies emphasized the value of disaster experience, simulation, and preparedness education in strengthening readiness [23]. Broader training literature also supported the role of advanced paramedic education in strengthening clinical performance [24].

As paramedic roles continued to expand within Saudi healthcare transformation, the evidence indicated a parallel need to strengthen disaster-specific competencies, leadership, and continuing professional development [5].

Professional and workforce context

Ethical and professional challenges were closely linked to operational preparedness. During disasters and mass-casualty incidents, paramedics might need to balance patient needs, limited resources, professional duties, personal safety, and rapid triage decisions while managing family or bystander interference and treatment refusal [25].

Studies also associated unclear protocols, limited leadership experience, insufficient preparedness training, communication constraints, and inadequate organizational support with greater decision-making difficulty and occupational stress [15,16]. Repeated exposure to traumatic events and high operational demands has been associated with anxiety, emotional exhaustion, burnout, psychological distress, and post-traumatic stress symptoms among Saudi EMS personnel [26–28].

Taken together, the evidence supported preparedness strategies that integrate technical training with leadership development, ethical decision-making, organizational support, communication systems, and psychological support for the EMS workforce [26] (Figure 2).

Discussion

This review identified 22 publications that contributed to the Saudi evidence base on EMS and disaster preparedness,

but they do not answer the same question. Only a subset directly assessed preparedness. The remainder described EMS development, education, workforce distribution, technology, or professional factors that might influence response capacity. Keeping these evidence levels separate is important: modernization and workforce development can create conditions for preparedness, but neither should be interpreted as a direct measure of readiness.

Direct preparedness evidence identified gaps in disaster-specific knowledge, practical exposure, role clarity, planning participation, and simulation experience [16,23]. In contrast, publications on infrastructure, trauma-system development, technology, and paramedic education primarily document changes in EMS capacity and organization [5,18].

Education is therefore a key bridge between system development and operational preparedness. Although national EMS education has matured, disaster-medicine content remains inconsistently represented, and studies described gaps in incident command, triage, simulation exposure, and practical training [19–23]. As paramedic practice expands, disaster curricula should increasingly address leadership, interprofessional coordination, ethical decision-making, and performance under resource-constrained conditions rather than focusing only on routine clinical competence [20,23,25].

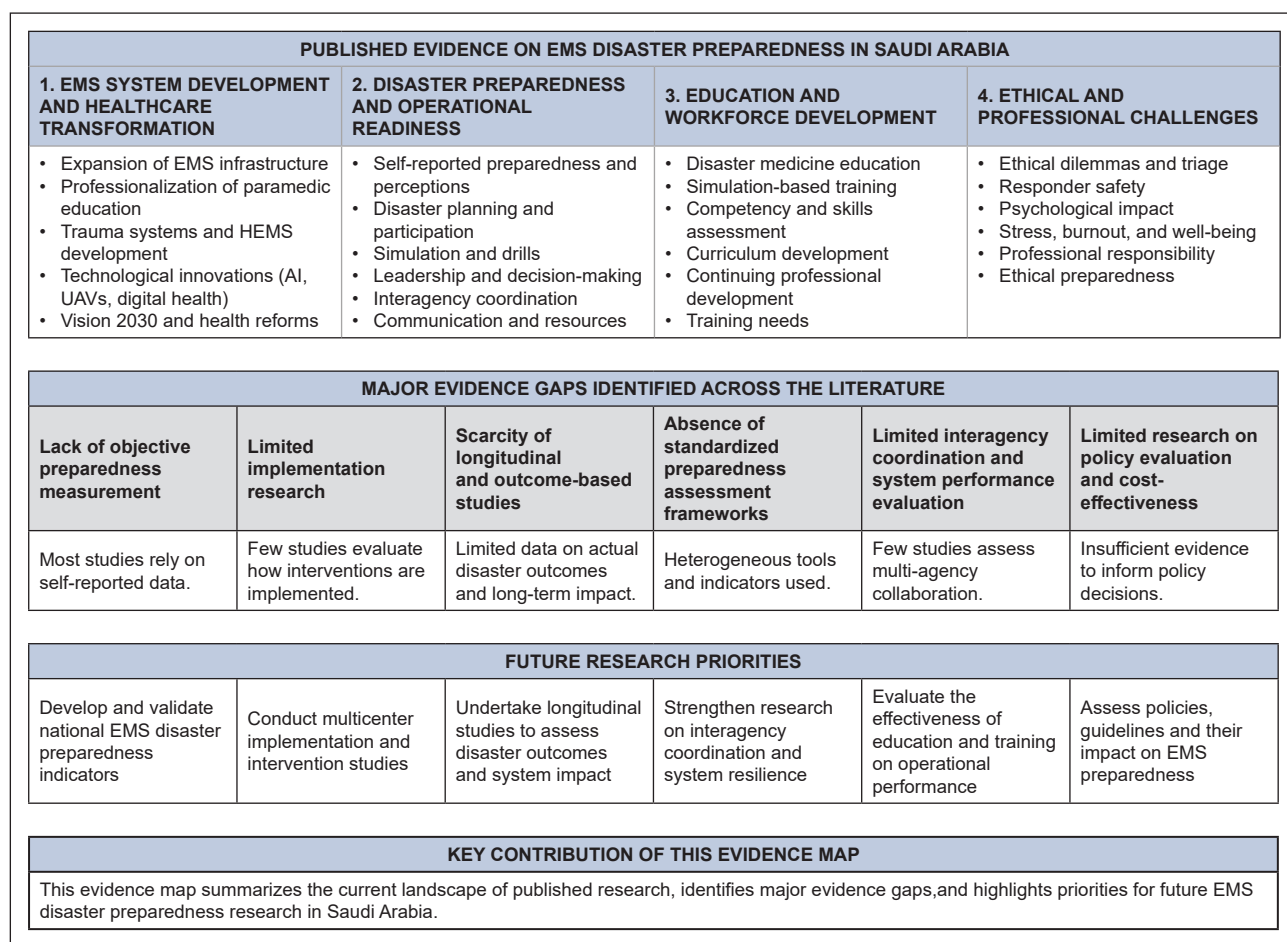


Figure 2. Evidence map of the published literature, major evidence gaps, and research priorities for emergency medical services and disaster preparedness in Saudi Arabia.

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Database	Search strategy
PubMed	((("Emergency Medical Services"[Mesh] OR "Emergency Medical Services"[tiab] OR EMS[tiab] OR "prehospital care"[tiab] OR prehospital[tiab] OR paramedic*[tiab] OR "emergency care"[tiab]) AND ("Disaster Planning"[Mesh] OR "Mass Casualty Incidents"[Mesh] OR "disaster preparedness"[tiab] OR "disaster response"[tiab] OR "emergency preparedness"[tiab] OR "emergency management"[tiab] OR "mass casualty"[tiab] OR "major incident*" [tiab] OR "system development"[tiab] OR workforce[tiab] OR education[tiab] OR training[tiab] OR coordination[tiab] OR resource*[tiab] OR technolog*[tiab]) AND ("Saudi Arabia"[Mesh] OR "Saudi Arabia"[tiab] OR Saudi[tiab]))
Scopus	TITLE-ABS-KEY (("emergency medical services" OR EMS OR "prehospital care" OR prehospital OR paramedic* OR "emergency care") AND ("disaster preparedness" OR "disaster response" OR "emergency preparedness" OR "emergency management" OR "mass casualty" OR "major incident*" OR "system development" OR workforce OR education OR training OR coordination OR resource* OR technolog*) AND ("Saudi Arabia" OR Saudi))
Web of science	TS= (("emergency medical services" OR EMS OR "prehospital care" OR prehospital OR paramedic* OR "emergency care") AND ("disaster preparedness" OR "disaster response" OR "emergency preparedness" OR "emergency management" OR "mass casualty" OR "major incident*" OR "system development" OR workforce OR education OR training OR coordination OR resource* OR technolog*) AND ("Saudi Arabia" OR Saudi))

Note. The database-specific search strategies were reconstructed during revision from the search concepts and eligibility framework documented for the original review because the original database search-history exports were not retained. The final search was conducted in May 2026.