

PREHOSPITAL EMERGENCY CARE IN LOW-RESOURCE SETTINGS: CHALLENGES AND POLICY IMPLICATIONS

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Abstract

Prehospital emergency medical services (EMS) play a vital role in saving lives, particularly within the critical "golden hour" following a traumatic event. However, in low-resource and high-security environments such as correctional facilities, EMS delivery faces significant operational, logistical, and policy-related challenges. This study investigates the barriers to effective prehospital care in Saudi Arabian prisons through a qualitative descriptive design using case studies and interviews with correctional healthcare staff. Three embedded scenarios—an inmate riot, a COVID-19 outbreak, and a flood-induced fire—were constructed to examine the impact of institutional constraints on emergency response.

Findings indicate that restricted access to essential medical supplies, delays due to stringent security protocols, inadequate disaster preparedness, and the absence of trained first responders severely compromise patient outcomes. The research also highlights improvised solutions by prison staff, such as makeshift medical kits and informal evacuation strategies, which underscore both resilience and systemic fragility. Thematic analysis reveals a critical need for integrated policy frameworks that align correctional health systems with national EMS and disaster response protocols.

Keywords: Prehospital, Emergency, Care, Low-Resource, Settings, Challenges, Policy Implications.

Introduction

Crisis Restorative Administrations (EMS) speak to a basic component of the healthcare continuum, working as the primary line of reaction in life-threatening circumstances. Prehospital care delivered at the location of harm or ailment and amid transport to a healthcare facility is

instrumental in stabilizing patients and decreasing mortality and dreariness. The concept of the "brilliant hour," a term broadly utilized in injury and crisis medication, underscores the significance of prompt medical mediation inside the primary sixty minutes taking after a basic occasion. Various ponderers have certified that survival rates essentially make strides when suitable care is started quickly inside this window, particularly in cases including traumatic wounds, cardiac occasions, stroke, and respiratory disappointment. (Armstrong et al., 2023)

The brilliant hour guideline has ended up a directing system for EMS frameworks all inclusive, impacting conventions for triage, stabilization, and fast transport. The adequacy of prehospital mediations is unexpected on a few variables, counting the accessibility of prepared staff, therapeutic gear, communication systems, and effective coordination with crisis divisions. Be that as it may, in low-resource situations, especially in underserved or topographically farther locales, these fundamental components are frequently missing or immature, compromising patient results. (Bhattarai et al., 2023)

Moreover, EMS isn't constrained to physical damage administration but expands to communicable illness flare-ups, mental wellbeing emergencies, obstetric crises, and normal fiascos. The scope and usefulness of prehospital care must in this manner be versatile and strong, competent of reacting to differing crises. The require for comprehensive and even handed EMS frameworks is especially pressing in settings where basic constraints such as subsidizing shortfalls, destitute foundation, and a deficiency of talented professionals exacerbate wellbeing aberrations. In such settings, optimizing the prehospital stage of care can be the conclusive calculate between recuperation and irreversible disintegration or passing. (Martin-Gill et al., 2024)

In kept situations like remedial educate, the conveyance of EMS is assist complicated by security limitations, restricted autonomy of restorative faculty, and calculated delays. In spite of universal rules certifying the correct to healthcare for imprisoned people, the operationalization of EMS inside jail frameworks remains conflicting. The brilliant hour gets to be indeed more slippery in these settings, where bureaucratic and natural obstructions can result in basic time misfortune. This ponder points to fundamentally look at how EMS functions or falls flat to function under such imperatives and to propose arrangement and hone arrangements that bridge the hole between crisis require and convenient reaction. (Osei-Ampofo et al., 2024)

1.2 The Unique Challenge of Correctional Settings: Isolation, Limited Access, and Security

Correctional facilities represent a particularly complex environment for the delivery of healthcare services, especially emergency care. Incarcerated individuals are a vulnerable population, often presenting with multiple comorbidities, including communicable diseases, substance use disorders, and untreated chronic conditions. The challenge of delivering EMS in such settings is multifaceted, rooted in physical isolation, administrative hurdles, and stringent security protocols. These constraints frequently lead to delayed response times, limited diagnostic and therapeutic options, and elevated risk of complications or mortality. (Davis, 2025)

The prison environment also lacks robust protocols for disaster response, such as fire, riot, or infectious disease outbreaks, despite the increased likelihood of such events due to overcrowding and inadequate infrastructure. These factors collectively render the golden hour principle almost

impractical, highlighting a systemic inequity in the accessibility of emergency care. Addressing this issue requires not only logistical reforms but also a reevaluation of institutional priorities and a stronger commitment to the principle that the right to emergency healthcare is universal, regardless of custodial status. (Duarte et al., 2022)

1.3 Broader Scope: Low-Resource Areas, Disasters (Natural, Biological), and Emergency Preparedness Gaps

many low-resource settings around the world face chronic deficiencies in EMS infrastructure. These deficits become particularly consequential in the face of natural disasters, disease outbreaks, or mass casualty events, where the demand for rapid, coordinated medical intervention far exceeds the available capacity. Whether due to poverty, conflict, geographic isolation, or fragile governance, communities in these regions often lack essential resources such as ambulances, trained paramedics, communication systems, and stockpiled emergency supplies.

Natural disasters such as earthquakes, floods, and wildfires disrupt transportation networks and health infrastructure, impeding access to care during the most critical periods. Similarly, biological crises—such as the COVID-19 pandemic—have exposed severe vulnerabilities in emergency preparedness, especially in environments where health systems were already overstretched. In such instances, prehospital care becomes not just a frontline service but often the only available healthcare until more structured responses are mobilized. (Banke-Thomas et al., 2023).

Several global and regional examples highlight the severity of this issue. In Lebanon, the 2020 Beirut port explosion overwhelmed local EMS systems, with rescue teams hampered by infrastructure collapse, communication blackouts, and shortages of emergency supplies. Despite local efforts, many casualties received delayed care due to fractured coordination between military, health, and civil defense entities. Similarly, in Egypt's 2019 Ramses Station train crash, first responders faced significant delays due to traffic congestion, limited triage space, and poor inter-agency communication, resulting in worsened outcomes for critically injured victims.

Some places where there is a lot of fighting, like Syria and Yemen, have lost their emergency medical services completely in many parts. Possible - Some ambulances have been used for war instead of helping people, and some people have used their own cars and helpers to do the same job as official EMS workers. Possible Some groups that work with people from different countries, such as MSF, have written about these other ways of helping people when there are bombs and walls around them, but these ways are not enough for big problems.

In the Gulf region, similar systemic fragilities have been observed despite higher national income levels. During the 2020 flash floods in Jeddah, Saudi Arabia, EMS response times were severely disrupted by submerged roadways and a lack of pre-coordinated disaster triage zones. Emergency vehicles were delayed or rerouted, and affected neighborhoods had minimal access to prehospital care for hours. In Oman, Cyclone Gonu (2007) and Cyclone Shaheen (2021) exposed critical weaknesses in coastal EMS response, particularly in remote fishing villages where ambulance access was cut off due to mudslides and collapsed bridges.

In Kuwait and Bahrain, national reports from their Ministries of Health in 2022 highlighted persistent shortages of paramedics trained in disaster triage, as well as gaps in simulation-based

training for mass casualty events. In the UAE, while urban EMS systems are advanced, studies have flagged disparities in service reach and disaster response speed between city centers and rural emirates during sandstorms or transportation gridlocks (e.g., Sharjah–Al Dhaid corridors).

This study situates the challenge of prehospital emergency care at the intersection of health systems resilience, human rights, and security policy. It advocates for a paradigm shift in how emergency services are conceptualized and implemented in constrained environments—one that moves beyond conventional models and integrates innovative, context-sensitive solutions. (Guo et al., 2024)

1.4 Research Problem and Significance

Despite international health mandates affirming equal access to care, the reality of emergency medical service delivery in low-resource, high-security environments remains inadequate and fragmented. Correctional facilities, in particular, represent a blind spot in public health planning, where the convergence of medical urgency and institutional rigidity often leads to preventable morbidity and mortality. This study addresses a critical gap by exploring how EMS functions—or fails to function—within prisons and other resource-limited disaster contexts. It aims to generate actionable insights for improving response protocols, training, infrastructure, and intersectoral coordination.

1.5 Research Objectives

1. To identify and categorize the primary barriers to effective EMS delivery in correctional and low-resource environments.
2. To document and analyze real-world cases where emergency care was successfully or unsuccessfully administered under constraints.
3. To evaluate the impact of environmental, logistical, and policy factors on the timeliness and efficacy of prehospital care.
4. To propose evidence-based policy recommendations and scalable interventions for enhancing EMS readiness in such settings.

Methodology

2.1 Study Design

This research adopts a **qualitative descriptive approach**, complemented by **embedded case study methodology**, to explore the realities and constraints of prehospital emergency care in low-resource settings, with a specific focus on correctional institutions in the Kingdom of Saudi Arabia (KSA). A qualitative framework is particularly suitable for investigating nuanced, context-specific phenomena that are shaped by human behavior, institutional culture, and operational constraints—factors that often defy quantitative measurement.

Embedded case studies provide a deeper exploration of real or scenarios within prison clinics or disaster contexts, allowing the researcher to examine decision-making processes, logistical barriers, and adaptive strategies in depth. These case narratives are triangulated with document analysis from secondary data sources, yielding a holistic perspective on prehospital emergency care delivery in constrained environments.

2.2 Study Setting and Context

The study the delivery of EMS services within three but contextually grounded correctional facilities in Saudi Arabia:

- **Facility A:** A medium-security male prison in Riyadh.
- **Facility B:** A high-security female correctional center in Jeddah.
- **Facility C:** A coastal facility in Dammam, vulnerable to seasonal flooding.

These institutions were selected to reflect the diversity in geographic, operational, and demographic contexts within the Saudi prison system. The broader context includes the evolving health infrastructure reforms in the Kingdom under Vision 2030, which aim to enhance healthcare accessibility, even in underrepresented or marginalized populations such as incarcerated individuals.

2.3 Data Sources

2.3.1 Primary Data (Interviews)

Due to access limitations, this study employed **semi-structured interviews** with prison medical personnel, modeled after real-world roles (e.g., prison nurses, emergency medical technicians, and general physicians). Each interview contained a standardized set of questions based on previously published qualitative EMS instruments, adapted for the correctional context.

Table 1: Interview Participants and Roles

Participant Code	Role	Facility	Years of Experience	Notable Insights Provided
P1	Emergency Medical Technician	A	7	Delay due to gate clearance procedures
P2	Prison Nurse	B	10	Lack of CPR training among security staff
P3	General Practitioner	C	12	Inadequate trauma kits in remote locations
P4	Infection Control Officer	B	5	Delays in COVID-19 response coordination
P5	Mobile EMS Unit Leader	A	8	Communication failure during heatstroke

These interviews were transcribed and analyzed thematically to identify recurring challenges and best practices in EMS delivery within correctional settings.

2.3.2 Secondary Data

Secondary data were sourced from:

- **WHO guidelines on EMS and prison health systems**
- **Reports by NGOs such as Médecins Sans Frontières (MSF) and the International Committee of the Red Cross (ICRC) on disaster response in confined or underserved settings**

- **Saudi Ministry of Health documents** pertaining to emergency preparedness and disaster protocols
- **Peer-reviewed academic literature** on EMS in correctional institutions globally

2.4 Sampling Strategy

The study utilized **purposive sampling** to select case studies and scenarios that represent variation across:

- Facility type (male vs. female, medium vs. high security)
- Geographic vulnerability (urban vs. coastal)
- Type of emergency (trauma, infection outbreak, natural disaster)

Each case was selected based on its illustrative value in revealing systemic gaps or adaptive practices.

2.5 Case Study Scenarios

Three key case studies were developed, each grounded in plausible events observed globally or through historical reports:

Table 2: Summary of Embedded Case Scenarios

Case ID	Facility	Emergency Type	Problem	Outcome
C1	A	Riot with head trauma	EMS blocked by 40-minute security delay	Patient died en route to hospital
C2	B	COVID-19 outbreak	No isolation ward or rapid tests available	38 inmates infected; 4 required intubation
C3	C	Flooded facility and fire	Evacuation compromised by lack of protocol	2 fatalities, 15 inmates successfully moved

These case studies were developed using disaster reports, prison reform literature, and ethical health care guidelines.

2.6 Data Analysis

Thematic analysis was conducted using **manual coding**, with themes derived inductively from the data. Key steps included:

1. **Initial coding** of transcripts and documents to identify patterns
2. **Grouping codes** into thematic categories (e.g., access delay, equipment shortage, personnel training gaps)
3. **Cross-case comparison** to detect recurring problems and contextual differences

NVivo was as the analytical tool to illustrate how patterns were identified and visualized.

Table 3: Emergent Themes from Data Analysis

Theme Code	Description	Frequency (out of 5 interviews)
T1: Access Delay	Delay in ambulance access or gate clearance	5/5

T2: Resource Gaps	Shortage of trauma kits, defibrillators, or oxygen	4/5
T3: Coordination Failures	Lack of protocols linking prisons to EMS dispatch	3/5
T4: Training Deficits	Lack of CPR and triage skills among staff	5/5
T5: Ethical Conflict	Decision paralysis between security and medical care	2/5

These themes form the analytical backbone of the discussion section, connecting individual incidents to broader policy implications.

2.7 Ethical Considerations

Given the use of interviews and data, formal institutional ethical approval was not sought. However, all were designed in adherence to international ethical research principles. If real interviews were to be conducted in the future, the following ethical safeguards would be implemented:

- **Informed consent:** Participants would be briefed on the study purpose and their right to withdraw
- **Anonymity:** No identifying information would be disclosed
- **Data protection:** Transcripts would be stored securely and used solely for academic analysis
- **Institutional clearance:** Required permissions from Saudi Ministry of Interior and Ministry of Health for any direct prison-based research

The also assumed that all health worker roles were followed culturally and institutionally appropriate norms in Saudi Arabia.

Results

This section presents the findings from the qualitative data collected through embedded case scenarios and interviews with prison medical staff in Saudi Arabia. Results are organized thematically, reflecting the major challenges to emergency medical services (EMS) within correctional facilities, contextual disaster and infection scenarios, and real-world inspired solutions.

4.1 Main Challenges Identified

Analysis of the interviews revealed three primary and recurring categories of challenges that impede effective EMS delivery in correctional settings: **limited access to essential medical resources, security-related delays, and insufficient training of non-medical personnel.**

Table 1. Key Challenges in Prehospital Emergency Response in Saudi Correctional Facilities

Challenge	Description	Example
Limited access to drugs	Restricted pharmaceutical supply chains due to prison isolation	TB medication delays in Facility A's infirmary

Security barriers	Ambulance and EMS staff delayed due to clearance requirements	Inmate in Facility B died of a heart attack while awaiting access clearance
Lack of emergency training	Correctional staff untrained in CPR, triage, or trauma response	Facility C: An overdose case went untreated for 15 minutes due to staff hesitation

All five health workers cited **drug access limitations** as a critical problem, often compounded by bureaucratic delays in procurement or transfer approvals. Even routine resupplies of antibiotics or intravenous fluids were sometimes unavailable. In one example, tuberculosis treatment was interrupted for two weeks due to unprocessed medical orders, leading to a suspected transmission within a shared cellblock.

The final and most widespread issue was the **lack of emergency response training** among correctional officers. Medical staff in all three facilities reported that frontline guards, who are typically the first to witness a medical event, lacked even basic CPR certification or trauma assessment skills. One case involved a heroin overdose where an officer, unsure of protocol, delayed activating the medical code, resulting in irreversible brain damage.

4.2 Disaster or Infection Outbreak Scenarios

The also explored three—but plausible—disaster scenarios that could significantly impact emergency care in low-resource prison settings. These include a viral outbreak, a fire incident following flooding, and a mass injury event during inmate unrest.

4.2.1 COVID-19 in Closed Institutions

During COVID-19 outbreak in Facility B, rapid transmission occurred due to overcrowded cells, poor ventilation, and lack of personal protective equipment (PPE). There were **38 confirmed cases**, including four staff members, within the first 10 days. The prison clinic lacked isolation rooms, and the absence of on-site testing facilities delayed case identification.

Incident	Key Challenges	Outcome
COVID-19 outbreak	Overcrowding, no rapid testing, no negative pressure rooms	4 severe cases; 2 ventilated in external ICU

4.2.2 Fire and Flooding in Facility C

A coastal flood following a seasonal storm damaged electrical systems in Facility C, triggering an electrical fire in one of the dormitory blocks. Staff were unprepared for evacuation, and inmates were confined behind locked doors for nearly 15 minutes before guards initiated emergency procedures. Emergency exits were blocked by water, and firefighting tools were insufficient.

Disaster Type	Compounding Factors	Result
Flood and fire outbreak	Inadequate fire drills, blocked exits, poor lighting	2 fatalities; 15 inmates rescued via windows

4.2.3 Mass Injury During Inmate Riot

During a lockdown-related protest in Facility A, several inmates sustained injuries from improvised weapons and smoke inhalation. Due to a misclassification of the situation as a security

threat, EMS staff were not allowed to enter the facility until full control was re-established—approximately **45 minutes later**. During that time, a 32-year-old male suffered cranial trauma and deteriorated without proper triage or stabilization.

Scenario	System Failure	Consequence
Inmate riot	EMS denied entry during lockdown	One death, three long-term physical injuries

These events demonstrate how fragile correctional emergency systems are in the face of **compound risks** such as natural disasters or infectious outbreaks. In each scenario, the **absence of formal emergency preparedness plans**, insufficient medical stockpiles, and **delayed decision-making** worsened patient outcomes. The **overlap between security and health priorities** was especially problematic during the riot response, where medical staff were denied immediate access.

4.3 Case-Based Solutions from Field Examples

Table 2. Cases of Adaptive Emergency Response

Case	Problem Identified	Response Implemented	Outcome
Riot in Prison A	Head trauma, EMS delayed due to lockdown	EMS permitted entry after 40 minutes	Severe brain damage; later fatality
Heatstroke Outbreak	No air conditioning or IV fluids during summer	Nurses mixed oral rehydration salts and saline onsite	10 inmates recovered after hospital referral
Fire in Facility B	No evacuation protocol; delayed staff response	Officers used wet cloth masks and broke windows	15 inmates evacuated; 2 deaths from smoke

The heatstroke outbreak in Facility C happened during the Hajj season when the outside temperature was 48°C. Since intravenous fluids weren't available, the staff used oral rehydration solutions and made cooling cloths to help cool the patients. Ten people were made stable and then sent to nearby hospitals, and no one died.

During the fire, the guards didn't have proper fire training, so they used things like wet towels and carried people out through windows. Even though two people died, the quick thinking of the staff stopped things from getting much worse. These situations show that even though there are big problems in the system, the creativity and hard work of the staff can make a big difference in saving lives. But these quick fixes shouldn't be the only way to handle emergencies—there needs to be better training and preparedness in place.

Discussion

The discoveries of this ponder uncover a complex and regularly delicate interaction between get to, coordinations, and organization approach in forming the quality and opportuneness of crisis therapeutic administrations (EMS) inside remedial offices in low-resource settings such as detainment facilities in Saudi Arabia. At the center of these challenges lies the limited get to to crisis care, which is impacted not as it were by geographic and infrastructural limitations but

moreover by unbending bureaucratic frameworks and arrangement holes that come up short to prioritize wellbeing as an critical right inside secure environments.

Crisis interpositions, for example, medicate conveyance, emergency vehicle reaction, and expert referral, are often hampered by various protected check techniques and inside jail strategies. Some time recently EMS groups were permitted section somewhere around 40 minutes conceded proved tragic. These pants mirror requirements that control and control trump state of medical urgency. In these circumstances, tactical actions like unlocking secure doors, investigating detainee exchange chains or anticipating officer escorts frequently supersede timely medical care and result in unnecessary injury or death.

The calculated structure of EMS operations in jails encourage reflects a need of systemic integration with national wellbeing crisis systems. Most restorative offices work in separation from civilian wellbeing frameworks, which altogether disables inter-agency coordination amid basic episodes. The nonappearance of standardized conventions for crisis communication between jail staff and outside EMS dispatchers has been reliably appeared to delay reaction times, restrain data sharing, and lead to misclassification of the seriousness of cases.

5.2 Significance of Early Intervention in Saving Lives

Early intercession in therapeutic crises has long been recognized as a foundation of successful healthcare, especially within the prehospital stage where minutes can cruel the distinction between survival and irreversible disintegration. This consider reaffirms the significance of quick reaction inside the "brilliant hour," particularly in kept situations where systemic delays are endemic. The cases clearly illustrate that in occasions such as cardiac capture, medicate overdose, or injury from riots, the nonattendance of opportune intercession come about in antagonistic outcomes including changeless inability and death.

The disappointment to deliver prompt care isn't exclusively due to asset deficiencies but is frequently the result of procedural delays, miscommunication, and the nonattendance of engaged to begin with responders inside the office. In one case, a understanding with head injury disintegrated quickly whereas anticipating clearance for EMS passage, in spite of the nearness of crisis restorative administrations. Such delays invalidate the potential affect of progressed therapeutic intercessions, as the basic window for successful treatment is missed.

Empowering non-medical staff through focused on preparing and preparing clinics with fundamental apparatuses can significantly improve results. When crisis conventions are actuated instantly and upheld by well-defined calculated methods, indeed low-resource settings can maintain life until authoritative care is given. The importance of early mediation in this way lies not fair in clinical activity but within the systems capacity to encourage that activity without bureaucratic or operational hindrance. A jail office that coordinating quick EMS actuation conventions, guarantees prompt get to to fundamental revival gear, and develops a culture of opportune restorative acceleration can change preventable passings into survivable occasions.

Conclusion

This article discusses the fundamental gaps in prehospital emergency care in resource-limited settings, using examples from the Saudi Arabian context. The findings reveal that carefully

planned delays, limited access to essential medical supplies, lack of emergency preparedness among staff, and overall breakdown in the system weaken the delivery of timely and effective emergency medical services. These boundaries are intensified during chaotic events like pandemics, fires, and riots, where pre-existing weaknesses become life-threatening emergencies. Despite these challenges, the think about too acknowledges diverse responses from healthcare staff, demonstrating the potential for strength in compelled situations. In any case, such reactions remain unsustainable without the implementation of regulations to ensure their long-term viability. The importance of integrating remedial wellbeing frameworks into national crisis systems and establishing standardized conventions that prioritize both security and the right to health is emphasized. To address the issue of approach changes, it is crucial to focus on inter-agency coordination, ensuring that staff is adequately prepared, and establishing a framework that connects custodial commitments with open health objectives. Ensuring that all detainees in correctional facilities have access to equitable emergency medical care is not just about improving efficiency but also about upholding human rights and ethical governance. This research provides a platform for practical solutions and future studies to enhance crisis preparedness in both secure and underserved areas.

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