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The history of emergency medical services response to mass casualty incidents in disasters, Saudi Arabia

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ABSTRACT

Mass casualty incidents (MCIs) in disasters across the globe are inevitable, and the emergency medical services (EMS) system has played a significant role during such events. This historical review seeks to examine the history of EMS response to MCIs in disasters in Saudi Arabia. Since the first recorded disaster in 1964, the Kingdom has witnessed a range of catastrophic events, causing many deaths and injuries and related economic damage. The country's EMS system dates back to 1934 when it was first incorporated into the health care system. Since then, EMS have responded to various MCIs by providing critical pre-hospital care to casualties during disasters. However, barriers affecting the service delivery often complicate those responses. Additionally, elderly people manifest unique challenges due to their age, which constrains EMS system effectiveness. Therefore, future studies should focus on such barriers to ascertain future EMS system efficiency.

Keywords: Disasters, Emergency Medical Services, Incidents, Mass Casualty, Saudi Arabia

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INTRODUCTION

A disaster is a catastrophic event, usually unforeseen, that causes major disruption to the normal conditions of existence, beyond the capacity of the local community to respond and requiring special mobilisation of resources and organisations.[1] Disasters have been globally classified as either naturally occurring, such as floods, storms, earthquakes and tsunamis, or man-made, such as fires, famines, stampedes and terrorist activities, which lead to loss of lives and destruction of property.[2,3] Both natural and man-made disasters are commonly associated with mass casualty incidents (MCIs). This term is used to classify events that overwhelm the existing health care systems and personnel due to the high number of casualties, exceeding local capabilities and resources in a short time period.[2,4]

Many people are affected by MCIs, and this necessitates the need for a quick response in order to minimise and contain their effects. MCIs need a well-organised and well-resourced approach and an effective system of medical personnel dispatch for the management of victim injuries at the scene, for evacuation and for transport.[5] Moreover, emergency medical services are central to the organisation and management of life-threatening conditions by triaging, stabilising and transporting casualties.[5] Therefore, the EMS play a major role in managing all phases of MCIs, including prevention, preparedness, response and recovery.[6]

Since the establishment of the Kingdom of Saudi Arabia in 1932, various types of disastrous events associated with MCIs have been witnessed, including floods, fires, stampedes, and terrorist attacks. For example, the flash flood of Al-Kaaba in 1941 was the first known disaster in the Kingdom.[7] However, there is a lack of the information available about this event, and its impact on society. Therefore, this review has focused attention on the catastrophes from 1964 – when a MCI occurred, caused by heavy rains and striking several parts of the country – onwards. This tragedy was the earliest recorded disaster in the Kingdom, resulting in 20 deaths and 1,000 injuries.[8–12] Disasters in Saudi Arabia increased in frequency and severity from 1980, resulting from that time to the present in more than 4, 660 deaths, impacting approximately 32,000 people and causing a loss of USD 4.65 billion in property and infrastructure.[13] Thus, such disasters have an effect both in human and fiscal terms.[13,14] In 2009, the Jeddah flooding caused more than 125 deaths and affected more than 10,000 people, destroying over 8,000 homes and 7,000 vehicles.[11–13,15,16] The community was concerned about these damages, which had been caused by slow emergency teams response, and poor sewage and rainwater networks.[11,17] As a result, the Saudi government has taken many short- and long-term measures to reduce the damage caused by floods, in order to alleviate the suffering of those affected and prevent similar disasters in the future. These measures include the establishment of educational training and simulation drills suitable for all personnel involved in responding, the development of preventive plans, the establishment of an early warning network, the provision of necessary equipment and community education.[15,18]

In 2015, in a stampede near the Islamic holy city of Makkah, 769 individuals who took part in the Hajj pilgrimage lost their lives.[19] As a result, the Saudi government, in cooperation with all concerned sectors, put in place several precautionary measures to avoid a repeat of such a catastrophic event. Such measures include increasing the number of personnel involved in the Hajj, coordination with Hajj missions from various Islamic countries, the deployment and installation of additional observational cameras, ensuring the readiness of all hospitals and health sectors in the holy sites, the establishment of electronic paths and gates in Al Jamarat to manage the crowds, support for the communication networks and distribution of electronic wrist straps to trace the flow of people and get early warnings from crowd gatherings.[20] However, the effects of this MCI on the Kingdom emphasised the need for an effective EMS response framework to manage the casualties.[19] Therefore, this review will explore the history of pre-hospital emergency management of MCIs in disasters in Saudi Arabia.

METHODS

A review of scholarly published sources from online databases, including Google Scholar and PubMed, Saudi health journals, university and government websites, and media reports was conducted to understand the historical development of the EMS response to MCIs in Saudi Arabia. Google Scholar was selected as one of the databases since it offers an opportunity to extensively search for scholarly sources across numerous subjects. PubMed was chosen because it provides a wide range of both biomedical and clinical literature relevant to the topic under focus. Articles on EMS and MCIs of Saudi Arabia as well as data from governmental websites and media reports were included in the review.

The context of the Kingdom of Saudi Arabia

Saudi Arabia is located in the west of the Asian continent and covers an area of 2,146,690 km^2, with a population of 32,552,336 million people.[21] Approximately 19% of Saudi citizens are aged 14 and below while 4.1% are aged 60 and above.[21] Immigrants (foreign residents who are living in the Kingdom for job purposes) account for 37.3% of the population and a further 18.6% of the citizens reside in the rural areas of the country.[21] The Kingdom consists of a desert, Rub' Al Khali (meaning 'Empty Quarter'), in which barely any people or animals live because of the extreme heat and infrequent rain, vegetation, and water.[22] In addition, the Kingdom of Saudi Arabia occupies a special place in the Islamic world because it has the most holy places in Islam, namely Makkah and Medina.[23] Therefore, the Kingdom is a destination for many Muslims on a yearly basis to perform Hajj and Umrah, which are considered among the five pillars of Islam. According to general statistics gathered during the past ten years, the Kingdom hosts between 2.0 and 3.2 million visitors or pilgrims every year during the Hajj season.[24]

The history of MCIs and their impact on Saudi society

Over the past five decades, the Kingdom of Saudi Arabia has experienced a number of MCIs associated with disasters that have claimed thousands of lives,[25] particularly between 1964 and 2015. During this period, the nation suffered from both natural and man-made disasters.[19]

In 1964, heavy rains caused flooding, resulting in the deaths of more than 20 people. At the same time, it was estimated that over 1,000 people were adversely affected, and in the process a humanitarian crisis unfolded.[8,9,12] In this particular incident, many people were left homeless and without necessities, such as food and water.

In 1975, Saudi Arabia experienced another MCI of intense magnitude when fire erupted throughout the over-populated tent city of Mina. At the time, pilgrims had congregated in a ceremony to mark the first day of the Hajj festival.[10,11] The fire caused the deaths of some 200 people, while many others sustained serious injuries.[10,11] It took the deployment of fire engines and helicopters to control the fire, which threatened to bring down the entire city.

In 1979, extremists, who were agitating for the dismissal of the House of Saud, seized the holy mosque of Makkah in Saudi Arabia.[26] Besides capturing the mosque, the insurgents grabbed control of the Masjid Al-Haram in Makkah and demanded that Muslims obey their leader.[26] The takeover led to deadly battles between the insurgents and the Saudi Special Forces, a conflict that lasted nearly two weeks.[26] In the end, more than 250 people were killed and 600 others injured.[27]

In addition, in 1985, the northwestern region of the country experienced heavy rains that resulted in flooding, leaving 32 dead and affecting another 5,000 people.[8,9,12,17,28] Thousands more were left without basic commodities like food and shelter, and there was destruction of infrastructure and loss of property to the tune of USD 450 million.[12]

In 1987, the city of Makkah saw a deadly clash between Iranian demonstrators and Saudi law enforcement. The conflict saw the deaths of over 400 people while 649 more sustained injuries.[29,30] A 1990 stampede in a tunnel in the city of Makkah was one of the most notable and deadliest MCIs to occur on Saudi Arabian soil. The riot resulted in the deaths of 1,426 people.[19,31] Four years later, in 1994, the city of Makkah witnessed the Hajj stampede, in which at least 270 pilgrims perished.[19,31]

In 1996, the Khobar Towers attack in that city underpinned the catastrophic rate of MCI events in Saudi Arabia. The bombing of the eight-storey housing project, was being used by a coalition of US forces. It was estimated that 19 people lost their lives while almost 500 sustained serious injuries.[32] In 1997, Saudi Arabia witnessed another MCI. During the incident, fire broke out and burnt makeshift tents being used by pilgrims. The incident led to the deaths of 343 people, with 1,500 more reported as casualties.[19,33,34] In 1998, a stampede at Al Jamarat Bridge in Mina, left 118 pilgrims dead and another 180 injured.[19] In May 2003, bombs exploded in major residential compounds in Riyadh, largely occupied by military contractors and other foreigners.[35] Thirty-four people died and more than 194 were injured.[35] Just a few days later, the Kingdom witnessed another disastrous event with a flood in the city of Makkah, leading to the deaths of 12 people and affected a further 50.[12] Finally, that November, another Riyadh compound was bombed, adding at least 12 more deaths and 122 injuries, bringing the two bombing incidents that year to a total of roughly 47 dead and 316 injured.[35]

In 2004, the Saudi government was challenged to deal with another MCI caused by a stampede in Mina valley that led to the deaths of 251 pilgrims during Hajj celebrations.[19] In 2005, the Kingdom

witnessed another flood disaster when heavy rain on Al Medina province caused flooding, leaving 29 dead and affecting a further 67 people.[12] Yet again in 2006, the nation experienced another MCI stampede. In that incident, during the annual Makkah pilgrimage, approximately 380 pilgrims are estimated to have lost their lives, while 280 sustained injuries.[19,31]

In 2009, Saudi Arabia faced heavy rains that caused floods on the western coast, with the city of Jeddah most affected. The storm led to the collapse of many residential buildings, including hospital laboratories, with databases lost in the process.[13,17] The incident led to the deaths of more than 125 people and affected a further 10,000 or more, destroying over 8,000 homes and 7,000 vehicles,[11–13,15,16] leaving the city with a total of USD 900 millions in economic loss.[12,17]

In 2011, once again, the city of Jeddah suffered another flood disaster, which left 11 people dead and the city with damages of USD 300 million.[12] Considering these recurring flood events, the government reviewed all previous medical emergency plans—for all exigencies—to alleviate the suffering of those affected and prevent any future repetitions. Plans and preventive measures against such incidents were incorporated into the newly established Centre of Disaster and Crisis Management in 2011.[18,36] In 2012, a fuel truck explosion caused by a collision with a bridge in Riyadh killed more than 20 people and left some 135 others injured.[37] In 2013, a flood of the Tabala area in Asir caused the deaths of 24 people and affected a further 900.[12]

On 22 May 2015, the Kingdom experienced another terrorist attack, this time the bombing of Imam Ali Mosque in the village of Al Qudaih. It killed 21 people and seriously injured dozens more.[38] Months later, on 6 August 2015, another terrorist attack, this time the bombing of the Special Emergency Forces mosque in the city of Abha, killed as many as 17 people.[39] Shortly after this event, and before the commencement of the Hajj on 30 August 2015, a crane in Makkah city collapsed, killing 107 dead and more than 230 injured.[40,41] Two weeks later, a stampede during Hajj celebrations in Mina Valley left a reported 769 people dead and 934 with serious injuries.[19] Later the same year, a huge fire gutted a residential building in the city of Khobar, at the Aramco Complex, leaving at least 11 people dead and over 200 others seriously injured.[42] By the end of that year, a fire broke out in the intensive care and maternity wards sections of a hospital in the southern region of the country, killing some 25 people and injuring 123.[43] Table 1 below provides a summary of the major MCIs that have taken place in Saudi Arabia between 1964 and 2015.

Table 1. Saudi MCIs from 1964–2015 (Number of deaths >10) [8–9, 11–13, 15–17, 19, 29, 31–35, 37–41, 43].

Type of MCIs	Year	Effects
Floods	1964	20 deaths and 1000 injuries, homelessness, and food insecurity
Fires	1975	200 deaths and numerous injuries
Siege of the Grand Mosque	1979	Deadly battles: 250 deaths and 600 injuries
Floods	1985	32 deaths plus another 5000 people affected, with a total destruction cost of US$ 450 million
Deadly clash between Iranian demonstrators and the Saudi law-enforcement	1987	402 deaths and 649 injuries
Stampede in a tunnel	1990	1426 deaths
The Hajj stampede	1994	270 deaths
The Khobar tower attack	1996	The eight-story Khobar tower bombing: 19 deaths, 555 injuries
Fires	1997	343 deaths and 1500 casualties
Stampede	1998	118 deaths, 180 injuries
Riyadh residential bombings on May 12	2003	34 deaths and 194 injuries
Makkah flood	2003	12 deaths plus another 50 people affected
Riyadh residential bombings on November 08	2003	12 deaths and 122 injuries
The Mina valley stampede	2004	251 deaths
Floods of Al Medina province	2005	29 deaths and another 67 people affected
The annual Makkah pilgrimage stampede	2006	380 deaths and 280 injuries
Floods	2009	Collapse of many buildings; more than 125 deaths, more than 10,000 people affected, plus damage to 8,000 homes and 7,000 vehicles, with a total economic loss of US$ 900 million.
Jeddah flood	2011	11 deaths, with a total destruction cost of US$ 300 million

Table 1. *Continued.*

Type of MCIs	Year	Effects
A fuel truck explosion	2012	More than 23 deaths and 135 injuries
Flood of Tabala area in Asir	2013	24 deaths, plus another 900 people affected
Bombing of Imam Ali Mosque	2015	21 deaths and dozens of others seriously injured
Bombing of the special emergency forces mosque	2015	More than 13 deaths plus an unknown number of casualties
Mecca's crane collapse	2015	107 deaths and 230 injuries
The Mina Valley stampede	2015	769 deaths and 934 injuries
Residential building fires in Khobar at Aramco Complex	2015	11 deaths and 200 injuries
Hospital fire in intensive care and maternity wards	2015	25 deaths and 123 injuries

The summary table provided above clearly shows that MCIs have significantly impacted Saudi citizens. According to Khan et al. (2016), these effects have mainly been caused by poor response, particularly by EMS, to the events. Thus, it is imperative to investigate and focus on the history of EMS in Saudi Arabia so as to be aware of its origins.

The history of EMS in Saudi Arabia

The Saudi Red Crescent Authority (SRCA) is the main body in the Saudi Kingdom responsible for overseeing EMS.[44,45] It was the first government organization during the early years of Saudi Arabia's healthcare system to provide care to the country's citizens in the pre-hospital setting. According to the SRCA, EMS were incorporated into the nation's healthcare system in 1934, following the formation of the National Ambulance Health Association (NAHA).[44,45] Initially, the national ambulance service was a function of the Public Health and Ambulance Authority, a government body tasked with providing ambulance services and healthcare to the public, particularly to the large number of pilgrims visiting religious sites such as Makkah and Medina.[44,45]

The establishment of the National Ambulance and Health Association (NAHA), which preceded the formation of the EMS, was circumstantial rather than planned.[45] During the Saudi–Yemen civil war in 1934, it became evident that a body was required that could provide emergency medical care for Saudi soldiers involved in the conflict.[44,45] In the years following the war, EMS coverage was limited to the two main religious cities: Makkah and Medina. These services were provided by a charitable organization named the Charitable Relief Society (CRS).[44,45]

After World War II, the financial situation of the charitable organizations providing EMS deteriorated, thus forcing the government to convert the CRS into a public entity. As a result, its name was changed to the Saudi Red Crescent (SRC). The institution's name was changed again in 2008, to the SRCA.[44,45] The renamed organization's duties were described as the provision of aid relief and ambulance services, and the conduct of humanitarian work in partnership with, or in accordance to, international treaties. As things currently stand, the SRCA is the body mandated to provide EMS in the Kingdom of Saudi Arabia.[44,45]

It is important to examine the EMS response to disasters that have occurred in the past, as this will significantly help the relevant authorities in their development of future response strategies. Appreciation of past approaches would prevent the repetition of mistakes and facilitate more effective and better management of mass casualty incidents by emphasizing the importance of staff training, response times, crowd control, medical amenities and security crowd profiling, as well as focusing on cross-disciplinary practice.

The EMS response to MCIs: Preparing the workforce

Saudi Arabia's EMS have contributed to managing and mitigating the effects of MCIs through the SRCA.[25] The SRCA uses a well-organized approach that includes the dispatch of trained units to emergency incidents and the training of medical personnel to respond to those situations, particularly during mass events such as Hajj and Umrah.[46] These efforts are ably demonstrated by the establishment of medical schools in different parts of the country, where medicine, nursing and applied medical courses are offered.[46] The establishment of such schools has played a vital role in increasing the number of qualified emergency physicians. For example, in 2004 the country had only four qualified emergency physicians; by 2013 there were more than 70 qualified emergency physicians working in the country.[46]

In the Kingdom of Saudi Arabia, EMS are managed by all the hospitals through the SRCA at no cost to citizens and other residents of the country. There are 165 ambulance stations in the Kingdom and every station has two ambulances.[46] The well-resourced Al-Noor Specialist Hospital is one of the main emergency departments in the Holy City of Makkah. In order to effectively contain MCIs, the SRCA is in perpetual preparation for such events. For example, in advance of the Hajj festival, the SRCA puts over 300 ambulances and approximately 20 advanced life support (ALS) vans on standby, to be used in response to MCIs.[46]

The deployment of EMS personnel and equipment has improved and been successful. For example, during the 2012 Hajj, the country's EMS received over 27,046 emergency calls, responded to over 20,210, and treated over 18,230 patients.[47,48] The EMS also deployed 100 mobile team doctors, 25 motorcycle units, 20 ALS response vehicles and 300 ambulance units two weeks before the Hajj.[47,48] Additionally, the SRCA deployed 600 volunteers and 1,750 EMS professionals to different treatment points across the area. These personnel were assigned to 47 posts and 26 stations that were strategically situated at certain areas around the event.[46–48] The SRCA also used a variety of systems to transport and manage emergency patients, thereby accommodating transportation and access issues. Teams of EMTs, physicians, and paramedics worked seamlessly together to meet patient needs.[47,48]

The EMS also played an integral role in responding to emergency cases in the 2015 Hajj, which was attended by an estimated 1,950,000 pilgrims. A stampede occurred at the Jaramat Bridge, causing the death of 769 people in just a few hours.[19] At the time of this incident, a large number of healthcare professionals including EMS responded to the incident site, treating people for injuries and other health problems.[19] The stampede saw the deployment of over 250 emergency medical staff, equipment, and supplies to Makkah province.[19] The medical technicians, nurses, and physicians attended to specific emergencies that required specialization in terms of care.[19] They also followed the primary tenets of disaster triage for mass casualty care, systematically classifying the injured with the view of prioritizing those who most needed care.

Despite these efforts by the Saudi EMS providers, the present system faces numerous problems in terms of its educational structure. The various Saudi universities that offer higher-level EMS educational programs do so inconsistently, an exigency that has presented challenges to Saudi paramedics. Colleges and universities have developed their own individual competencies and expectations as a result of the rapid development of the field of pre-hospital care. Basic first-aid, post-employment training courses have turned into recognized bachelor's programs.[44] The disparities are particularly evident when performing a review of Saudi EMS college and university programs. To add to this complexity, the Saudi EMS education system has not adopted any discernible official competency standards that conform to practices of nations that have developed EMS systems for MCIs and other disasters. In fact, the development of local Saudi competency standards is apparently lacking, with the exception of the Alanazi model, an immeasurable limitation related to localization.[44] As a result, there is uncertainty as to what needs to be done by Saudi paramedics. A mismatch between EMS employment industry competencies and educational institutions could also be a consequence of such inconsistencies. Paramedics from various universities and colleges may treat and communicate with their patients differently, since paramedic guidelines and medical oversight are less capable of dealing with various medical ambiguities and diverse pre-hospital circumstances and contexts.

During Hajj, for instance, EMS providers face numerous challenges.[47,48] The hundreds of languages spoken by pilgrims is one of the key issues encountered by EMS providers. This is the case even though custom-designed picture books are employed to assist pilgrims in communicating the severity, location, and condition of their illness or injury to EMS personnel. This strategy has not yet been sufficiently effective, due to the difficulty in predicting the exact number of books needed each year. This deficit may lead to many patients being left untreated and not receiving proper assistance.[46–48]. The other key problem associated with popular religious events, such as Hajj and the annual Makkah pilgrimage, is that such events are usually attended by a large number of elderly people, many of whom have preexisting health conditions.[47,48] EMS staff often face difficulties when attending to those people, as some of them refuse care, believing that receiving health treatment may prevent them from fulfilling their religious obligations.[47,48] Such circumstances put paramedical staff in a difficult position, in that they cannot do anything for those who refuse critically important treatment.

Over the past few years, medical supplies have become another key problem associated with mass gatherings related to religious events such as Hajj and Umrah. The EMS have experienced challenges associated with calculating the need for crucial medical supplies and other essentials during the Hajj.[47,48] This is mainly because the government blocks major roads in order to control traffic. While this strategy is normally applied as a way to reduce road congestion, it also prevents ambulances from restocking their medical supplies,[47,48] thus depriving EMS clinics of much-needed medications and equipment for managing MCIs.

The EMS were also significant during the 2009 Jeddah floods. These floods led to the deaths of more than 125 people and negatively impacted at least another 10,000 people.[12,13,17] The EMS evaluated the event afterwards, examining how the health-related impact of flood could be effectively handled. The country's Ministry of Health (MOH), through its committee, provided ambulances, medical equipment and supplies, as well as determined the worst-affected areas from a health perspective. To prevent the floods from spreading further, the EMS undertook preventative medical measures, such as educating the public on how to respond to floods, putting emergency numbers at strategic locations, setting aside more funds, etc. However, the EMS and government responses were criticized. It was felt there was inadequate community preparedness and awareness, poor coordination between responsible organizations, and inadequate training of response teams.[16,25]

Implications of and challenges faced by the EMS' response to MCIs

Generally, the implementation of EMS strategies when dealing with MCIs has uncovered several challenges. Listed below are some of the most common problems seen in such situations over the last five decades:

- Long response times when called for emergencies;
- Inconsistencies in EMS personnel education of offered by universities and colleges, highlighted by inconsistencies in approaches to emergency care;
- The need to accommodate elderly people with existing health conditions who are on pilgrimages;
- Challenges faced when accessing medical supplies;
- Lack of a common language when providing EMS to those on pilgrimage.

Recommendations and future directions

Many of the barriers and challenges preventing the EMS system from effectively responding to MCIs have been identified here. These issues are faced during disasters not only in Saudi Arabia but also across other Middle Eastern countries. Removal or mitigation of these barriers will require the implementation of several measures and improvements in order to achieve the EMS' goals, that is, to provide timely care to sufferers of sudden and/or severe injuries in emergencies in such a way that avoids needless mortality or enduring injury.

Over the years, a failure to identify the threats and hazards that lead to MCIs has been the primary reason why such events occur. Therefore, there is a need to evaluate the causes of previous disasters and to use the resulting information to devise a proper mechanism whereby MCIs can be prevented or effectively managed.[25] For example, research should be conducted to establish what leads to stampedes. The information thereby gathered would be vital, as it would create an awareness of the need to avoid overcrowding, thus reducing the number of casualties.

It is also necessary to make certain that there is ongoing engagement and collaboration between the various agencies responding to MCIs; this would ensure the effectiveness of the efforts to manage such incidences. For example, agencies working in concert can ensure the timely and effective dispatch of emergency medical equipment and personnel, thus drastically reducing the time taken to respond to emergencies.[44] However, challenges may still appear in disasters where demand exceeds supply to such a degree that the community is overwhelmed.

Next, to solve the challenges associated with language barriers, it is advisable to identify the various languages spoken by pilgrims during Hajj and train EMS staff in the use of advanced communication technology, such as a verbal translator device or mobile application. This will make it easier for emergency medical practitioners to engage with their patients during emergencies, contributing to the achievement of the mission and vision of the EMS.[49]

To address the inconsistencies observed in the EMS training offered by the various Saudi universities and colleges, educational programs and skill learning should be standardized from a competency perspective; this would have the effect of enhancing the level to which paramedics safely and sufficiently deliver patient care.[11] It will also ensure that professionals accurately and reliably make decisions concerning safety, available equipment, patient condition, the scene and numerous other factors that contribute to pre-hospital care challenges. The Australian Council of Ambulance Authorities (CAA) is an example of an organization that has demonstrated how the educational competence of universities can be standardized. Australia adopted a UK competency model that would thereafter accredit academic institutions as per the CAA's own competency requirements.[44] Such an approach might be applicable in Saudi Arabia, albeit with changes. The Saudi context differs from that of Western nations in several ways (such as culture). As such, completely adopting some Western core competencies might be ineffective when dealing with Saudi citizens' and residents' needs.

Finally, academic institutions need to provide an opportunity for EMS students to participate in mass gatherings such as Hajj and Umrah.[48] Such participation would probably improve the student's knowledge and skills, thereby ensuring the effectiveness of the healthcare provided by the EMS providers when responding to various types of health emergencies and MCIs.

Limitations of this study

When carrying out this review, certain limitations became evident. First, there is a lack of well-researched, published articles on the concept of EMS responses to MCIs, which makes it difficult to collate the necessary information required for this study. Second, the study specifically uses secondary data, which may be biased. Namely, most available articles focus exclusively on certain events, rather than taking an overall view; this may give an incomplete picture of the ability of EMS providers to appropriately respond to a variety of catastrophic events. Third, this research was narrowed down to only few emergencies; it does not consider the many events that have occurred from the 1960s to the present day. This is because of a lack of reported information about these MCIs and other disasters on the available research database. Therefore, generalizing these findings to apply to EMS responses to other disasters and MCIs might prove a challenge. Finally, this study only included Saudi EMS providers that work for the MOH and SRCA, excluding those that work for other Saudi Ministries, including the Ministry of Defense and National Guard hospitals. Articles that cover SRCA leaders' knowledge of preparedness for MCIs were excluded as well. Thus, there is a need to focus on such articles in any future review.

CONCLUSION

This paper aimed to investigate the history of EMS responses to MCIs in Saudi Arabia. Over the last five decades, the country has been faced with numerous emergencies, both natural and man-made, to disastrous effect, such as deaths, injuries, and humanitarian crises. The Saudi EMS has a long history and has been overseeing emergency medical services in a pre-hospital setting since 1934. In addition, various research studies have showed that the EMS has contributed to the management and mitigation of the effects of MCIs. It is now easier to manage and reduce the risks associated with emergency conditions; this is mainly due to the dispatch of EMS teams in areas that are likely to face incidents of mass casualty emergencies. However, there continue to be different types of challenges associated with the concept of EMS responses to MCIs in disasters. Therefore, it is important to comprehensively examine how effectively the EMS responds to MCIs and disasters in the Middle East in order to ensure improved efficiency. Despite the availability of EMS in Saudi Arabia, there is not enough evidence regarding EMS responses in the context of MCIs and disasters in the Kingdom of Saudi Arabia. This information is important if we are to understand those of the current challenges faced by the EMS that are related to how they respond to MCIs and recommend improvements accordingly.

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