ORIGINAL ARTICLE

Assessing Saudi Paramedics Preparedness for Mass Casualty Incidents and Disasters: A Descriptive Quantitative Study

Waleed Alazmy

Department of Basic Science, Prince Sultan College for Medical Emergencies, King Saud University, Riyadh, Saudi Arabia

Abstract

Objectives: This study investigates the preparedness of Saudi paramedics for mass casualty incidents (MCIs) and disasters. **Methods:** A cross-sectional study-using questionnaire was conducted among Saudi paramedics. A total of 480 ambulance stations of the Saudi Red Crescent Authority (SRCA), located around its 13 administrative regions (SRCA, 2019) were included. A response rate of 94.8% ($n = 455$) through a convenience sampling approach was obtained. Three factors were assessed: Roles and responsibilities, preparedness, and barriers to responding effectively. **Results:** Participants reported a limited understanding of their roles and responsibilities, while the majority of participants reported a moderate knowledge of preparedness. Different barriers show a moderate impact on preparedness ranging from (mean [M] = 6.65, Standard deviation [SD] 2) to (M = 7.87, SD = 2.54). **Conclusion:** The present study recommends the improvement of paramedics' preparedness for MCIs and disaster through mock drills, training, and a curriculum for preparedness. Leadership skills also need improvement for paramedics to enhance their preparedness for MCIs and disasters.

Key words: Disasters, emergency medical services, mass casualty incident, paramedic, preparedness, Saudi Arabia

INTRODUCTION

Emergency medical services (EMS) play a key role in planning, preparedness, response, and recovery from mass casualty incidents (MCIs) and disasters, leveraging their multidisciplinary expertise and readiness for injury and illness management.[1,2] The increasing frequency of MCIs and disasters, including terrorist attacks, demands sustainable resources and improved emergency response coordination from governments and relief organizations.[3] MCIs and disasters can arise from various sources, such as mass gatherings, extreme climate conditions, biological catastrophes, terrorism, armed conflicts, or transport accidents.[4,5] By definition, an MCI overwhelms the local healthcare system with a large number of casualties, while disasters significantly disrupt social functions, resulting in substantial human, environmental, and material losses that exceed the affected community's ability to cope.[6] On the other hand, disasters are defined as a significant disruption of normal social functions and result in large human, environmental and material losses that exceed the affected community/society/nation's ability to cope using its existing resources exclusively.[7] Hence, both MCIs and disasters create major healthcare delivery concerns, requiring EMS to be constantly evaluating their preparedness to respond.[7]

EMS providers, including paramedics tasked with responding to MCIs and disasters, first need to be competent in their primary job skills. Throughout their 50-year history, EMS providers have consistently been the leaders in disaster management through their preparedness planning, communication and coordination, patient care and transport, triage assessment, and response to hazardous materials.[2,8] In Saudi Arabia, MCIs and disasters have claimed thousands of

Address for correspondence:
Waleed Alazmy, Department of Basic Science, Prince Sultan College for Medical Emergencies, King Saud University, Riyadh, Saudi Arabia.
E-mail: walazmy@ksu.edu.sa

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lives,[9] causing the death of more than 5,200 people between 1963 and 2020.[9] The Saudi government acknowledges the potential impact of MCIs and disasters and continues to equip healthcare organizations including EMS and all other involved agencies with the capacity to respond.[10] According to Alotaibi and Khan, EMS providers have played a key role in disaster management. Over time, the EMS physicians' national association has worked to strengthen the roles of EMS personnel.[8] Effective management of MCIs and disasters in Saudi Arabia in the future lies in the preparedness of EMS providers.[11]

Saudi Arabia has a long history of managing potentially hazardous situations dating back to its establishment in 1932. These include situations resulting from sudden climate change, terrorist attacks, religious gatherings, and many other situations such as biological warfare that might result in MCIs and economic loss.[9] In 2009, a sudden change in the climate led to heavy rains on most of the western coast of Saudi Arabia, where Jeddah was one of the most affected cities.[9,10] The geographical location and poor infrastructure of the city drainage systems led to a sudden and rapid accumulation of rainwater inside the city and, consequently, to severe flooding within the city.[9,12] For that reason, the Saudi EMS afterwards examined how health-related effects of the incident could be handled effectively, while the Ministry of Health (MoH) took the responsibility for providing logistical support, disaster response supervision, and identifying the most affected areas.[9,10] Moreover, to prevent the spread of the floods' effects, the EMS carried out preventive medical actions, such as educating the public on how to tackle the floods and their related health challenges, providing additional funding, and placing emergency hotlines at strategic points.[9,10]

The consequences of the Hajj stampede of 2015 led the Saudi government to put measures in place to prevent such an occurrence in the future. This included doubling the emergency medical response personnel during the Hajj pilgrimage, installing additional cameras in the city, improving the healthcare service providers and facility preparedness and readiness for medical emergencies across the city, deploying communication networks at strategic locations in the area, and finally using technology through wrist straps that monitor the crowd movement.[9,10] Still, despite all the measures put in place by the Saudi government, EMS providers should be ready to manage MCIs and disasters since the discussed two cases demonstrated the level of unpreparedness and underdevelopment of emergency response in Saudi Arabia. However, the timing and nature of MCIs and disasters are commonly unpredictable, thereby prompting EMS providers to be always prepared to provide a rapid and sustained response to such events.[13] However, this is not the case in Saudi Arabia since at least some MCIs and disasters are foreseeable and expected at any time during the heavy rain seasons and mass gathering events during Hajj and Umrah.[13] The increasing frequency of MCIs and disasters prompts the question: how prepared are Saudi paramedics for MCIs and disasters? Alrazeeni pointed out the need for EMS providers to have adequate knowledge, leadership abilities, and organizational skills to perform their roles competently.[7] A key step in emergency management is that disaster preparedness at all phases and levels of response promotes efficacy when a disaster happens.[7] According to Catlett *et al*., it remains difficult to assess the EMS community's preparedness in the absence of "specialized training and well-defined core competencies in disaster management." The Saudi Ministry of Interior proposed that ministries and institutions, including the Saudi Red Crescent Authority (SRCA), develop disaster plans, which would be compiled to create a national plan for effective management of disasters.[7]

This process was established to enhance collaboration between institutions, ministries, and other sectors for improved efficacy in the management of disaster responses likely to occur in different parts of Saudi Arabia. Enhanced disaster preparedness and management would allow improved responses to public health crises and the medical consequences of potential disasters. Nonetheless, there is limited in-depth research into the preparedness of Saudi paramedics for MCIs and disasters.[7,8] This study investigates the preparedness of Saudi paramedics for MCIs and disasters.

METHODS

Design

This study used a cross-sectional quantitative design to describe the MCI/disaster preparedness status of the Saudi EMS in MCIs. The data collection for this study was conducted in Saudi Arabia and included all 480-ambulance stations of the SRCA, located around its 13 administrative regions.[14]

Sampling

Similar to earlier studies,[15-20] convenience sampling technique was employed, including SRCA paramedics who have at least a diploma of 2 years or equivalent certification in EMS. A total of 1007 paramedics were contacted directly by visiting the target sites at the researcher's home city where the questionnaire forms had been handed out and collected in-person and through an online link sent by email (for those who were living outside the researcher's home city).

Instrumentation

A previously validated questionnaire on disaster nursing competencies developed by Al Thobaity was used (with permission) in this study.[21] Given that emergency response teams work collaboratively when responding to disasters, the instrument has proved to be culturally congruent.[21] In addition, the instrument has evidence of excellent reliability

for nursing with a Cronbach's alpha coefficient of 0.86–0.98 with multi-dimensionality of three factors.[21] The tool was designed in English, which is the formal language used by Saudi paramedics in their studies and daily communication in healthcare facilities. Therefore, the instrument will help to inform paramedics' competencies for MCIs and disasters in Saudi Arabia. For that, minor word changes were made in some items addressed to EMS. The entire questionnaire comprised four parts. Part one contained 10 demographic questions including the participant's gender, age, educational background, employment history, response to disasters, participation in MCI/disaster management training/education, formal qualifications, and any additional professional qualifications. The other three parts used the 10-point Likert scale method that started from "not important" to "extremely important" and included (i) roles and responsibilities, (ii) preparedness, and (iii) barriers in responding to MCIs and disasters. Part four had eight items related to barriers to developing core competencies.

Procedures

Plain language information and a consent letter that explained the aim of the study and requested informed consent were enclosed with an English version of the questionnaire. It was distributed to participants through hard copy or an online link of the questionnaire sent through e-mail depending on the participant's availability and willingness to complete the questionnaire.

Data analysis

Quantitative analysis was carried out through descriptive measurements to define sample features of the entire study, including frequencies and percentages of the demographic data (gender, age, nationality, qualification in EMS, and working experience); measuring frequencies (n), mean (M), and standard deviation (SD) for separated and combined factors; and sub-items for each factor. Cronbach's alpha coefficients were calculated for the internal consistency of the items.

Ethical consideration

Ethical approval to conduct the study was obtained from Prince Sultan Bin Abdulaziz College for EMS at King Saud University. All participants were informed of the purpose of the study and the mechanism of participation including their voluntary involvement, absolute confidentiality, secure storage of received data, and their right to withdraw at any time before completing and returning the questionnaire. Return of the completed questionnaire was considered as consent of participation in the study. The study also adhered to the ethical standards set by the Kingdom of Saudi Arabia.

RESULTS

The response rate was 94.8% (n = 455) of the total distributed questionnaires, of which 73% (n = 332) were completed on the paper version and 27% (n = 123) were completed electronically. The analysis found a high percentage of missing data on four variables, three of which were a sub-item of some of the demographic data while the other one was optional and represented the participant's opinion about the questionnaire. The missing data showed a high percentage between 69.0% and 95.6%: organization of training (69.5%), formal qualification in MCI or disaster management, certification or award, or institution of training (91.4%), data of demography (country of training 95.6%), and 72.1% missed values also belonged to the optional question. Thus, missing values were removed from the analysis and were considered insignificant.

Demographic data

Of the 455 participants, 98% were male and 2% were female. About one-third of the participants (35.8%) were <30 years old, while almost half (48.8%) were between 30 and 39 years. The majority of the participants were Saudi Arabian (96%), held a bachelor's degree (58.2%), and more than one-third had 1–10 years of experience, while the minority had more than 11 years of experience (26.8%) [Table 1].

Factor 1: Roles and responsibilities

The descriptive statistics for roles and responsibilities focused on five items presented in Table 2. The highest mean score

Table 1: Demographic profile of participants

Attribute	Category	Frequency	Percentage
Gender	Male	446	98.0
	Female	9	2.0
Age	20–29	163	35.8
	30–39	222	48.8
	40–49	63	13.8
	50–65	7	1.5
Nationality	Saudi	437	96.0
	Non-Saudi	18	4.0
Qualification in EMS	Higher diploma	164	36.0
	Bachelor's degree	265	58.2
	Master's degree	17	3.7
	Doctoral degree	5	1.1
	Others	4	0.9
Working experience as a registered EMS paramedic	1–5 years	164	36.0
	6–10 years	169	37.1
	11–15 years	60	13.2
	>15 years	62	13.6

EMS: Emergency medical services

(M = 5.42, SD = 2.95) was the "I participate in mock drills on a regular basis" item, and the lowest mean score (M = 4.12, SD = 3.12) was for the item "I participate in developing plans and policy in pre-hospital health care organizations." The overall mean score on the 10-point Likert scale for the first factor was 4.69 (SD = 2.63), which was below average but toward the middle magnitude of the "never" response to "very often" response of the 10-point scale. The Cronbach's alpha reliability test found that the roles and responsibilities factor had excellent internal consistency ($\alpha = 0.90$).

Factor 2: Preparedness

The descriptive statistics for the preparedness factor focused on 32 items as presented in Table 3. The highest mean score (M = 8.98, SD = 1.72) was for the "EMS professionals should be able to understand the purpose of MCI/disaster plan" item, and the lowest mean score (M = 6.73, SD = 3.00) was for the item of "EMS professionals should be able to list long-term consequences of exposure to an overwhelming situation."

The overall mean score on the 10-point Likert scale for the second factor was 8.38 (SD = 1.48), which was above average (moderate level). Moreover, the average mean scores for all items individually ranged from 6.73 to 8.98 and were sorted in ascending order, as shown in Table 3. Moreover, the analysis identified that preparedness had an overall reliability score of $\alpha = 0.96$, and when the item deletion test performed, the overall items do not influence the overall reliability; therefore, none of the 32 items needs to be deleted.

Factor 3: Barriers to responding to MCIs/disasters

The descriptive statistics for Factor 3 focused on the eight items presented in Table 4. The highest mean score (M = 7.87, SD = 2.54) was for the "Lack of evaluation tools" item and the lowest mean score (M = 6.65, SD = 2.61) was for the item of "Ineffective training opportunities."

Table 2: Descriptive statistics of Factor 1 (roles and responsibilities)

Variables	*n*	M	SD
I participate in developing plans and policy in pre-hospital health care organizations	455	4.12	3.12
I am authorized to activate a local disaster plan	455	4.24	3.10
I participate in education and training activities for health care providers	455	4.83	3.13
I have a role in identifying the education and training needs of paramedics	455	4.85	3.21
I participate in mock drills on a regular basis	455	5.42	2.95
Factor 1 - combined mean	455	4.69	2.63

n: Frequency, M: Mean, SD: Standard deviation

The overall mean score on the 10-point Likert scale for Factor 3 was 7.28 (SD = 2.10), which was above average (moderate level). Moreover, the average mean scores for all items individually ranged from 6.65 to 7.87 and were sorted in ascending order, as shown in Table 4. The Cronbach's alpha was $\alpha = 0.92$, showing high reliability for Factor 3, while it would be about 0.91 for all if the item deletions occurred.

Analysis of variance (ANOVA)

ANOVA checks were conducted on the impact of age, working experience, times responded to actual MCI/disaster, and times participating in MCI/disaster drill (demographic variables) on all three factors [Tables 5-8].

The results of the one-way ANOVA test [Table 5] indicate a significant difference between the age and Factor 1 (roles and responsibilities), F (3,451) = 3.312 at the level of $P < 0.02$, but no significant differences in the means of the other factors.

The results of the one-way ANOVA test [Table 6] indicate no significant differences ($P > 0.05$) in the means of all the factors.

The results of the one-way ANOVA [Table 7] indicate significant differences in the means of all factors among groups, with F (3,451) = 8.166 at the level of $P = 0.00$ for F1, F (3,450) = 4.078 at the level of $P = 0.01$ for F2, and for F3, F (3,451) = 5.330 at $P = 0.00$.

The results of the one-way ANOVA [Table 8] indicate significant differences in the means of the factor "participation in MCI and/or disaster drill(s)" with F (3,451) = 3.546 at the level of $P = 0.02$. The other *P*-values ($P < 0.05$) for one-way ANOVA are not significant for the other two factors.

DISCUSSION

EMS providers including paramedics play a critical role in MCIs and disasters as they work on the frontline of pre-hospital health care for survivors. MCIs/disasters can occur in any geographical area or time without warning (unpredictable). Saudi Arabia is likely to experience disasters that are more devastating in the future, leading to negative health impacts such as the loss of lives, injuries and destruction of property and infrastructure worth billions of dollars, and many other disastrous scenarios. Moreover, due to their magnitude and devastating effect, MCIs and disasters can disrupt businesses and overwhelm the country's healthcare system when there are no proper preparations on the part of the paramedics involved in EMS response.[8,10,22] This is enough reason to make paramedics' preparedness for MCIs and disasters a national priority.

Table 3: Descriptive statistics of Factor 2 (preparedness)

Variables	*n*	M	SD
EMS professionals should be able to list long-term consequences of exposure to an overwhelming situation	455	6.73	3.00
EMS professionals should be able to describe strategies for allocating scarce resources in an ethical manner to optimize population outcomes during treatment	455	7.06	2.57
EMS professionals should be able to manage volunteers	455	7.17	3.01
EMS professionals should be able to participate in processes of securing adequate supplies for patient care	455	7.57	2.39
EMS professionals should be able to identify vulnerable populations and coordinate activities to reduce risk	455	7.74	2.15
EMS professionals should be able to list the appropriate steps for requesting psychological first aid for responders, patients, and other victims	455	7.80	2.25
EMS professionals should be able to identify human behaviors that put individuals at risk during an MCI/disaster	455	8.11	2.06
EMS professionals should be able to participate in creating new guidelines for EMS practice	455	8.27	2.13
EMS professionals should be able to describe the principles of crisis communication in risk management	454	8.28	1.99
EMS professionals should be able to provide defensible solutions to a series of ethical dilemmas arising in MCI/disaster	455	8.28	2.01
EMS professionals should be able to describe EMS providers' roles in various MCI/disaster assignments (e.g., shelters and emergency care sites)	455	8.29	2.14
EMS professionals should be able to use recordkeeping processes (collecting and saving data) to ensure continuity of patient information	455	8.34	2.13
EMS professionals should be able to describe the phases of MCI/disaster management continuum: Prevention/mitigation, preparedness, response, and recovery/rehabilitation.	455	8.38	2.27
EMS professionals should be able to provide up-to-date information to MCI/disaster response team regarding health care issues	455	8.46	1.97
EMS professionals should be able to manage resources required to provide care in the community	455	8.47	2.06
EMS professionals should be able to develop and maintain a personal preparedness plan	455	8.51	1.94
EMS professionals should be able to identify potential threats with medical implications in response areas	455	8.55	2.04
EMS professionals should be able to participate in planning to meet health care needs	455	8.56	1.94
EMS professionals should be able to prioritize patients to maximize survivability	455	8.60	2.04
EMS professionals should be able to identify and communicate important information immediately to appropriate authorities	455	8.70	1.84
EMS professionals should be able to recognize a disaster plan in the workplace	455	8.75	1.70
EMS professionals should be able to maintain knowledge in areas relevant to MCI/disaster response	455	8.76	1.85
EMS professionals should be able to understand relevant MCI/disaster terminology	455	8.79	1.77
EMS professionals should be able to facilitate and perform patient transport effectively during an MCI/disaster	455	8.79	1.74
EMS professionals should be able to recognize one's role in the workplace at the time of a disaster	455	8.80	1.83
EMS professionals should be able to participate in drills in the workplace	455	8.87	1.71
EMS professionals should be able to demonstrate an ability to follow and work within an incident management system	455	8.90	1.78
EMS professionals should be able to understand how to manage multiple situations concurrently	455	8.92	1.82
EMS professionals should be able to understand the components of an MCI/disaster plan	455	8.92	1.72
EMS professionals should be able to list and apply principles for managing patients with the most common victim presentations, for example, environmental illnesses; burns; blast and crush injuries; nuclear, biologic, and chemical exposures	455	8.93	1.87
EMS professionals should be able to perform safety procedures during an MCI/disaster	455	8.95	1.77
EMS professionals should be able to understand the purpose of MCI/disaster plan	455	8.98	1.72
Factor 2 - combined mean	455	8.38	1.42

n: Frequency, M: Mean, SD: Standard deviation, EMS: Emergency medical services, MCI: Mass casualty incident

Factor 1: Roles and responsibilities

The results demonstrate that there is a limited level of understanding among respondents about their roles and responsibilities in MCIs and disasters. Several factors support these findings. First, respondents indicated that they had limited participation in developing plans and policies within their scope of practice. It may be related to a lack of local expertise for plan development, as well as the Saudi EMS dependency on the MoH for the management of MCIs/disasters.[23] Nevertheless, there is no national master plan for disaster management in Saudi Arabia; however, every healthcare provider has its own disaster plan which can be activated when necessary.[7,23]

Table 4: Descriptive statistics of Factor 3 (barriers in responding to MCIs/disasters)

Variables	*n*	M	SD
Ineffective training opportunities	455	6.65	2.61
Lack of health organization support	455	6.94	2.71
Lack of expert staff in MCI/disaster response and management	455	6.99	2.61
Lack of training programs in the workplace	455	7.1	2.64
Lack of formal educational resources	455	7.21	2.56
Restriction of EMS professionals' roles in MCI/disaster management	455	7.72	2.64
Lack of research studies on MCI/disaster EMS response	455	7.73	2.59
Lack of evaluation tools	455	7.87	2.54
Factor 3 - combined mean	455	7.28	2.10

n: Frequency, M: Mean, SD: Standard deviation,
EMS: Emergency medical services, MCI: Mass casualty incidents

Early activation of a local disaster plan is crucial to minimizing the negative impact and saving lives. However, our study findings indicate limited participation in local plan activation among participants. According to the Saudi General Directorate of Civil Defense, declaring a disaster is under their purview.[10] Previous studies have shown that paramedics face limited confidence from doctors and nurses, who question their knowledge and skills in managing disasters, including activating internal disaster plans.[10,24] Furthermore, participants with experience in responding to actual MCIs or disasters reported significant differences in their understanding of roles and responsibilities. To address this, Duong recommend that health professionals participate in real or simulated drills to clarify their roles and responsibilities and enhance disaster competencies.[25]

Third, participation in education and training activities is essential for EMS providers to improve disaster outcomes.[2] However, our study found limited participation in training activities and decision-making related to educational needs for MCIs/disasters. This is consistent with previous studies that reported paramedics' insufficient disaster training.[8,14] While paramedics receive adequate training for routine tasks, they require specialized training for MCIs/disasters.[24] Disaster drills are an effective way to simulate disaster conditions, transfer knowledge and skills, and prepare responders for stressful environments.[11,26,27] However, our study showed limited participation in disaster drills, which may impact responders' ability to effectively respond to MCIs/disasters. This finding is consistent with Al-Otaibi's study, which reported that one-third of respondents lacked previous MCI/disaster drill training. In addition, our study found a significant mean difference in the impact of age on role and responsibilities, potentially due to older paramedics' increased exposure to MCIs/disasters over time.[1]

Table 5: Differences in the mean values of factors according to participants' age

Variables	Sum of squares	DF*	Mean square	F	Significant
F1					
Between groups	1698.08	3	566.03	3.31	0.02
Within groups	77074.65	451	170.89		
Total	78772.73	454			
F2					
Between groups	4361.07	3	1453.69	0.704	0.55
Within groups	929456.97	450	2065.46		
Total	933818.037	453			
F3					
Between groups	243.77	3	81.26	0.28	0.84
Within groups	129289.79	451	286.67		
Total	129533.55	454			

Factor 1: Roles and responsibilities, Factor 2: Preparedness, Factor 3: Barriers to responding to mass casualty incidents/disasters.
*Degrees of freedom

Table 6: Differences in the mean values of factors according to participants' experience working as registered emergency medical services paramedics

Variables	Sum of squares	DF*	Mean square	F	Significant
F1					
Between groups	479.48	3	159.83	0.921	0.43
Within groups	78293.25	451	173.59		
Total	78772.73	454			
F2					
Between groups	11172.19	3	3724.06	1.816	0.14
Within groups	922645.85	450	2050.32		
Total	933818.04	453			
F3					
Between groups	330.64	3	110.21	0.385	0.76
Within groups	129202.91	451	286.48		
Total	129533.55	454			

Factor 1: Roles and responsibilities, Factor 2: Preparedness, Factor 3: Barriers to responding to mass casualty incidents/disasters.
*Degrees of freedom

Table 7: Differences in the mean values of factors according to participants' experience in responding to an actual mass casualty incidents/disaster

Variables	Sum of squares	DF*	Mean square	F	Significant
F1					
Between groups	4058.63	3	1352.88	8.166	0.00
Within groups	74714.10	451	165.66		
Total	78772.73	454	1352.88		
F2					
Between groups	24712.78	3	8237.59	4.08	0.01
Within groups	909105.26	450	2020.23		
Total	933818.04	453			
F3					
Between groups	4435.336	3	1478.445	5.330	0.00
Within groups	125098.216	451	277.380		
Total	129533.552	454			

Factor 1: Roles and responsibilities; Factor 2: Preparedness; Factor 3: Barriers to responding to mass casualty incidents/disasters.
*Degrees of freedom

Factor 2: Preparedness

The present study revealed that participants had a moderate level of preparedness, which is concerning given the government's attention to the annual mass gathering of millions of pilgrims and the high risk of MCIs/disasters, such as the 2015 Hajj stampede. Several studies have emphasized the need for strategies to ensure timely and effective responses to MCIs/disasters, including the development of standards and scope of practice for enhancing preparedness.[2,24,28] Despite this, EMS students and paramedics have demonstrated a lack of preparedness to respond to MCIs/disasters.[7] The level of preparedness varies across Saudi Arabia, with Makkah and Madinah showing higher levels of preparedness due to increased government attention and funding.[8] The general knowledge of participants about MCIs/disaster preparedness was moderate, with a significant mean difference concerning participants' experience in responding to actual MCIs/disasters. Practical experience in disaster response and planning is essential, but currently lacking among EMS providers.[7] The findings suggest that paramedic participation in education and training for disasters is inadequate, which may be due to prior knowledge, education, and training gained through undergraduate courses.[7] However, research has shown that undergraduate education can positively impact disaster preparedness.[25]

Table 8: Differences in the mean values of the factors according to participation in mass casualty incidents and/or disaster drill (s)

Variables	Sum of squares	DF*	Mean square	F	Significant
F1					
Between groups	1815.36	3	605.12	3.55	0.02
Within groups	76957.37	451	170.64		
Total	78772.73	454			
F2					
Between groups	8442.68	3	2814.23	1.37	0.25
Within groups	925375.35	450	2056.39		
Total	933818.034	453			
F3					
Between groups	518.29	3	172.76	0.604	0.61
Within groups	129015.27	451	286.07		
Total	129533.55	454			

Factor 1: Roles and responsibilities, Factor 2: Preparedness, Factor 3: Barriers to responding to mass casualty incidents/disasters.
*Degrees of freedom

Factor 3: Barriers to responding to MCIs/disasters

The present study identified several barriers to effective disaster response, including ineffective training opportunities and a lack of training programs in the workplace, which negatively impacted role and responsibilities and core competencies. This finding is supported by previous research, which highlighted the importance of well-defined core competencies and standardized training in disaster preparedness and response.[2,29] Proper education and training are essential for paramedics in Saudi Arabia to improve their core competencies.[23,24] Integrating disaster knowledge and practical training into undergraduate EMS curricula can help prepare EMS students for disaster management.[7] Establishing competency-based emergency preparedness and management curricula is necessary to improve training and enhance the preparedness of EMS professionals.[29] However, several barriers exist, including limited health organization support,[21] a lack of expert staff in disaster/MCI management and response,[30] and restrictions on EMS professionals' scope of practice.[28] Developing performance metrics and evaluation tools is crucial for measuring disaster response and preparedness.[29]

Recommendations and future research

Improving paramedic preparedness for MCIs/disasters requires a multi-faceted approach. This can be achieved by fostering training programs and mock drills, implementing competency-based core curricula, and adopting standardized training with well-defined core competencies. In addition, ensuring the effectiveness of training programs, promoting health organization support, and providing educational and emergency response tools are crucial. Enhancing paramedic motivation and reviewing participation in drills and training programs are also essential. A unified approach with management support and national recognition across government departments is necessary to implement these recommendations effectively. Future research opportunities exist to explore the changes required to achieve this goal, including training program pilots and national studies.

Limitations

This study has several limitations. First, it only captured the perspectives of Saudi paramedics, excluding other EMS providers internationally and healthcare professionals such as nurses and doctors. Second, the use of questionnaires (paper-based and electronic) may have led to misinterpretation of questions, resulting in inaccurate information. The researcher's inability to meet all participants and collect data from paramedics working outside his home city due to safety concerns and time constraints also limited the study. The COVID-19 pandemic posed additional safety risks, contributing to a lower response rate than anticipated. Furthermore, the study sample was predominantly male (98%) and skewed towards the 30–39 age group, which may limit the generalizability of the results. Despite these limitations, the study provides a valuable starting point for discussion and lays the groundwork for further research on MCIs and disaster preparedness and response among EMS and health professionals.

CONCLUSION

This study aimed to conceptualize Saudi paramedics' preparedness for MCIs and disasters, revealing that most paramedics had a limited understanding of their roles and responsibilities and moderate knowledge of core

competencies. To strengthen disaster management, the primary recommendation is to improve preparedness across different organizational hierarchies within the government. Specifically, the Saudi EMS should focus on enhancing training through standardized programs, comprehensive competency-based emergency response curricula, and education initiatives. In addition, providing paramedics with new tools and methods to improve performance, coordination, planning, and communication is essential. Incentivizing paramedics can also promote motivation and increase the effectiveness of training, ultimately enhancing their preparedness for MCIs and disasters.

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REFERENCES

1. Al-Otaibi AM. An Assessment of the Disaster Preparedness Knowledge of Emergency Medical Services Providers in Hajj of 2016 [Thesis]; 2018.
2. Beyramijam M, Farrokhi M, Ebadi A, Masoumi G, Khankeh HR. Disaster preparedness in emergency medical service agencies: A systematic review. J Educ Health Promot 2021;10:258.
3. Abosuliman SS, Kumar A, Alam F, Rasjidin R. Disaster Planning and Management in Jeddah, Saudi Arabia. Conference: 2013 International Conference on Economics and Social Science; 2013.
4. Samarkandi OA, Khan AA, Alazmy W, Alobaid AM, Bashatah AS. The pulmonary consequences of sandstorms in Saudi Arabia: A comprehensive review and update. Am J Disaster Med 2017;12:179-88.
5. Wong DF, Spencer C, Boyd L, Burkle FM Jr., Archer F. Disaster metrics: A comprehensive framework for disaster evaluation typologies. Prehosp Disaster Med 2017;32:501-14.
6. DeNolf RL, Kahwaji CI. EMS mass casualty management. In: StatPearls. Treasure Island, FL: StatPearls Publishing; 2018.
7. Alrazeeni D. Saudi EMS students' perception of and attitudes toward their preparedness for disaster management. J Educ Pract 2015;6:110-6.
8. Alotaibi MS, Khan AA. Assessing the pre-hospital care preparedness to face mass casualty incident in Saudi Arabia in 2017-2018. Saudi Med J 2019;40:1032-9.
9. Alazmy W, Samarkandi OA, Williams B. The history of emergency medical services response to mass casualty incidents in disasters, Saudi Arabia. J Emerg Med Trauma Acute Care 2020;2020:3.
10. Alraga S. An investigation into disaster health management in Saudi Arabia. J Hosp Med Manage 2017;3:18.
11. Al-Wathinani A, Hertelendy AJ, Mobrad AM, Alhazmi R, Althunayyan S, Molloy MS, *et al*. Emergency medical providers' knowledge regarding disasters during mass gatherings in Saudi Arabia. Sustainability 2021;13:3342.
12. Alamri YA. Rains and floods in Saudi Arabia. Crying of the sky or of the people? Saudi Med J 2011;32:311-3.
13. Gabbe BJ, Veitch W, Curtis K, Martin K, Gomez D, Civil I, *et al*. Survey of major trauma centre preparedness for mass casualty incidents in Australia, Canada, England and New Zealand. EClinicalMedicine 2020;21:100322.
14. AlShammari T, Jennings P, Williams B. Evolution of emergency medical services in Saudi Arabia. J Emerg Med Trauma Acute Care 2017;2017:4.
15. Syed W, Al-Rawi MB. Assessment of awareness, perceptions, and opinions towards artificial intelligence among healthcare students in Riyadh, Saudi Arabia. Medicina (Kaunas) 2023;59:828.
16. Syed W, Samarkandi O, Alanazi AA, Alotaibi N, Al-Rawi MB. Assessment of myocardial infarctions knowledge, attitudes and beliefs among adults living in Riyadh Saudi Arabia-insights from cross-sectional study. Sci Rep 2024;14:31457.
17. Syed W, Alsadoun A, Bashatah AS, Al-Rawi MB, Siddiqui N. Assessment of the knowledge beliefs and associated factors among Saudi adults towards blood donation in Saudi Arabia. Hematology 2022;27:412-9.
18. Samreen S, Siddiqui NA, Wajid S, Mothana RA, Almarfadi OM. Prevalence and use of dietary supplements among pharmacy students in Saudi Arabia. Risk Manag Healthc Policy 2020;13:1523-31.
19. Alobaid AM, Syed W, Al-Rawi MB. Evaluation of headache trends among undergraduate first responders for medical emergencies at Saudi University in Riyadh, Saudi Arabia. Medicina (Kaunas) 2023;59:1522.
20. Syed W, Al-Rawi MB. Assessment of sleeping disorders, characteristics, and sleeping medication use among pharmacy students in Saudi Arabia: A cross-sectional quantitative study. Med Sci Monit 2023;29:e942147.
21. Al Thobaity A. Exploring Disaster Nursing Core Competencies and Roles in Kingdom of Saudi Arabia (KSA). Malaysia: Monash University; 2016.
22. Wajid S, Samreen S, Sales I, Bawazeer G, Mahmoud MA, Aljohani MA. What has changed in the behaviors of the public after the COVID-19 pandemic? A cross-sectional study from the Saudi community perspective. Front Public Health 2022;10:723229.
23. Alyami A, Dulong CL, Younis MZ, Mansoor S. Disaster preparedness in the kingdom of Saudi Arabia: Exploring and evaluating the policy, legislative organisational arrangements particularly during the hajj period. Eur J Environ Public Health 2020;5:em0053.
24. Alanazi AF. Emergency medical services in Saudi Arabia: A study on the significance of paramedics

and their experiences on barriers as inhibitors of their efficiency. Int J Appl Basic Med Res 2012;2:34-7.
25. Duong K. Disaster education and training of emergency nurses in South Australia. Australas Emerg Nurs J 2009;12:86-92.
26. Al Thobaity A, Plummer V, Innes K, Copnell B. Perceptions of knowledge of disaster management among military and civilian nurses in Saudi Arabia. Australas Emerg Nurs J 2015;18:156-64.
27. Almutairi AL, Salleeh HM, Khan AA. Confidence of Saudi emergency medical service's students in disaster response capability. Saudi J Emerg Med 2021;2:262-7.
28. Leggio W. Experiencing hajj: A phenomenological qualitative study of paramedic students. Australas J Paramed 2016;13:1.
29. Catlett CL, Jenkins JL, Millin MG. Role of emergency medical services in disaster response: Resource document for the national association of EMS physicians position statement. Prehosp Emerg Care 2011;15:420-5.
30. Achora S, Kamanyire JK. Disaster preparedness: Need for inclusion in undergraduate nursing education. Sultan Qaboos Univ Med J 2016;16:e15-9.

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