Emergency Medical Services Challenges Regarding Resource Capacity and Competency during COVID-19 Pandemic in Makkah City

Abstract

Objectives:

This study aimed to investigate the availability of resources, PPE (PPE) and beliefs amongst Emergency Medical Services (EMS) professionals in Makkah city. Also, we aimed to assess various aspects of how Emergency Medical Services are handling the COVID-19 pandemic via online self-administrated questionnaire.

Methods: A cross-sectional analysis was conducted on a convenience sample of 276 EMS providers from the city of Makkah in Saudi Arabia during the period from July 2020 to June 2021. SPSS (version 21.0) was used for data entry and data analysis. We approximate a 95% confidence interval (±0.05).

Results: Emergency Medical Technicians (EMTs) and paramedics are representing most of the participants, 44% and 43%, respectively. EMS doctor, EMS registered nurse and others represent the remaining 13%. When the participants assessed their level of satisfaction on how their institutions have handled the pandemic, 34% expressed that they were satisfied, 14% were very satisfied, while 21% and 13% expressed that they were dissatisfied and very dissatisfied. On the availability of resources, 42% had access to N95 masks whenever they needed access to them while 33% did not have access.

Conclusion:

As the study demonstrates a relationship between the capability of EMS personnel to handle a pandemic like COVID-19 and institutional preparedness, there are still significant gaps in EMS personnel's PPE training. EMS agencies should be supported in their efforts to effectively prepare their workers while the pandemic continues in our communities. Therefore, institutions should adopt guidelines that stipulate care for patients with COVID-19, provide training to emergency personnel, and properly distribute resources and PPE.

Keywords: Emergency Medical Services; COVID-19; Resource Capacity; Competency

List of Abbreviations:

COVID-19: coronavirus disease
EMS: emergency medical services
EMT: emergency medical technician
IRB: institutional review board
PPE: Personal Protective Equipment

INTRODUCTION

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The list of abbreviations is not necessary.

The first case of coronavirus (COVID-19) infection was confirmed in Wuhan, China in December 2019.[1] Saudi Arabia confirmed its first case in March 2020, shortly before COVID-19 was declared a global pandemic by the World Health Organization on March 11, 2020.[2] By June 8, 2020, the total number of confirmed cases of COVID-19 worldwide was 6,799,713, and the number of deaths was 377,388 in 216 countries.[3] The majority of global advanced emergency systems have rapidly become overwhelmed, and overcrowded emergency departments are at risk of spreading the highly infectious disease.[4] Few studies have been conducted in this domain around the world, and no such studies have been conducted in Makkah or Saudi Arabia.[5]

Since the severe acute respiratory syndrome (SARS) outbreak in 2003, several public health events have exposed shortages of PPE reserves,[6] resulting in an overall understanding of the need for researching medical supplies for public health emergencies and establishing systems of medical supply reserves. As a result, countries have been developing and improving their medical systems to effectively address these emergencies.[7] Despite these preparations, COVID-19 continues to spread rapidly as asymptomatic individuals can spread the virus during its incubation period.[8]

As the pandemic developed, this shortage of medical supplies became even more clear, especially the PPE such as N95 masks and protective clothing.[9] Emergency departments are the main access points for patients with undifferentiated or acute illnesses[10] and bridge the gaps in health care for vulnerable patients. Former public health emergencies like, (Coronavirus disease (COVID-19) outbreak, Measles emergency in the European Region and Ukraine's humanitarian crisis) and incidents of mass casualties have demonstrated that the public relies heavily on these emergency medical services. Within this context, communicable diseases such as COVID-19 pose several clinical and ethical challenges to emergency medical services. Public health emergencies of this nature have resulted in controversies regarding the protection of health care providers and their duty to provide treatment.[11,12]

COVID-19 has the potential to affect the Saudi Arabian health care system in an unprecedented manner. The epidemiological data from China suggests that the SARS-CoV-2 virus causes mild effects in 81% of infected patients, with a fatality rate of 2.3% among the general population.[13] However, the fatality rate increases to approximately 15% among patients ≥ 80 years of age.[14] In patients considered critically

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It is estimated that approximately 5% of patients with COVID-19 require critical care support, and recent data from Italy suggests that this number may be higher.[15] The number of patients requiring emergency medical services due to COVID-19 has surpassed the available resources in most countries. The risk of health care providers contracting the disease while working is also of great concern.[16] Worldwide, thousands of health care providers have been infected with the SARS-CoV-2 virus. However, the proportion of health care providers that have developed severe infections has decreased over time.[14]

The emergency medical service sector in Makkah regards COVID-19 as an illness that is moderately severe and highly transmissible, suggesting that there is potential for a substantial disease burden.[17] It is projected that critical care resources will continue to be overwhelmed.[17] The supply of important medical consumables including PPE is significantly decreased in Saudi Arabia and most developing countries, most of which rely on donations from the World Bank, developed nations, and individual donors.[18] According to international experiences, critical care, ward, and invasive ventilation resources may be rapidly overwhelmed by the relatively high volume of patients in this pandemic.[19] Alternate management options such as palliative and supportive care in residential aged care facilities will continue to be considered.[20,21]. These should be developed through community consultations.[22]

Over the last two decades, the system for assessing Saudi Arabia's health emergency management has faced numerous tests in the form of public health emergencies.[23] Most countries, including Saudi Arabia, need to improve their operational systems for decision-making and health emergency command.[24] In China, there are temporary emergency outbreak command centers established to handle health emergencies, which allows temporary commanders to determine emergency arrangements and decisions.[25,26]

The COVID-19 pandemic has the potential to challenge the construction of emergency care delivery in Makkah and across Saudi Arabia. Critical anticipation of the clinical and ethical challenges that may arise due to the overwhelming demand for health care is needed.[27] While clinicians and health care professionals have a strong sense of professional responsibility, it may be compromised as a result of increased sub-optimal engagement and visibility of risks from public health authorities and hospital managers.[20] Several challenges, including scarce resources, render the delivery of emergency medical services in Makkah difficult. Providers must be supported so they can make informed decisions.[28] Health care providers in emergency departments are required to make challenging decisions, with transparent, contemporary, and evidence-based guidance on epidemiological data, international experience, and consumer consultation.[29] This can help clinicians and physicians to contextualize and anticipate the health care needs of patients with COVID- 19, which will maximize the value of health care while minimizing moral injury to patients, staff, and families.[29] The objective of this study was to investigate the level of preparedness and perception of emergency medical service providers during the COVID-19 pandemic.

METHODS

STUDY DESIGN: To investigate the perception of EMS providers on handling COVID-19 and level of hospital preparedness, a cross-section study was used during the 11 months of the study from July 2020 to June 2021. Since there has not been a previous

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similar study concerning hospital readiness during COVID-19 crisis In Makkah, Saudi Arabia, the research was exploratory and descriptive statistics were mostly used to establish significance and inference.

STUDY SETTING: The study targeted all EMS institutions and hospitals in Makkah city that have handled COVID-19 cases both in private institutions and government facilities. The EMS system in Saudi Arabia suits the Anglo-American model which includes an emergency physician, paramedics who are trained in basic, intermediate, and advanced life support, technicians, firefighters, and ambulance drivers. [34] Annually, EMS teams transfer more than 70000 cases to hospitals including public, Military, and National Guard facilities. They provide first-aid care to victims until reaching hospital including stabilization, intervention, transportation for further management. EMS services can be classified into BLS (basic life support) that is dispatched to those needing non-invasive intervention, and ALS (advanced life support) that deliver cases who require higher levels of prehospital care. [35]

SAMPLE SIZE: The targeted population for the study includes all EMS providers in Makkah city. From convenience sampling of EMS professionals in the city, a cross-section sample size equation was used to calculate the sample size with a 95% confidence interval and margin of error of 0.05. The targeted sample size was 240 participants.

n = estimated sample size

$z\alpha = 1.96$

d= 0.05

INCLUSION AND EXCLUSION CRITERIA

The inclusion and exclusion criteria are shown in Table 1.

DATA COLLECTION: The data was collected using an online self-administered questionnaire that was sent to 240 healthcare providers including (emergency medical technicians, paramedics, respiratory therapist, EMS registered nurses, and EMS doctor) from government and private EMS institutions through convenient sampling techniques using the website link during November and December of 2020. The questionnaire included the following socio- economic items (age, gender, level of education, years of experience, area of expertise, private or public institution, and whether they have contracted COVID-19). The second part of the questionnaire was focusing on COVID-19 related practices and sanitation practices. It includes whether there is a specific training and how every participant find it. Whether PPE and disinfectants are accessible and how participants think about their institution's preparedness for the pandemic. The last part of

the questionnaire is measuring knowledge among the participants regarding COVID-19 (Prevention, transmission, Symptoms). The primary endpoints of the questionnaire were to assess the knowledge and competency of the EMS providers on COVID-19. A close-ended questionnaire on the availability of resources, availability of PPE (PPE), practices of emergency medicine sanitation, and institutional policies was designed.

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The secondary endpoints of the questionnaire assessed the challenges faced by EMS personnel during the outbreak of the contagious COVID-19 virus, to evaluate the health care provider's opinions about the current hospital preparedness and their satisfaction level, and in addition, development of effective strategies to manage this crisis and improve the quality of pre-hospital emergency care. A satisfaction level questionnaire with strongly agree, agree, neutral, disagree, and strongly disagree items was then used to assess the attitude and perception of the participants.

Validity of the questionnaire: The questionnaire was carefully revised by panels of healthcare professionals including epidemiologists, physicians, paramedics, and members who are native English speakers. It was developed in English for physicians and paramedics and translated into Arabic for technicians using a forward-backward translation by two qualified, independent translators to ensure its accuracy. Pilot tests of both versions were carried out by 20 healthcare workers to ensure the validity of the questionnaire. The validation is required to determine the time needed to complete the questionnaire and make sure that all questions are phrased clearly to avoid bias that might otherwise. The original questionnaire can be modified if required after the pilot survey.

DATA ANALYSIS: The data was entered, organized, tabulated, and analyzed by using the standard computer program IBM SPSS Statistics for Windows, version 21.0 program (IBM Corp., Armonk, N.Y., USA). Demographic and socioeconomic status data was tabulated and expressed as frequency and percentage of the total participants. Pie charts and bar graphs were used to illustrate the frequency distribution of the different variables. ANOVA and Chi-square tests were used to test the significance of the difference in the distribution of responses and the association of the stated variables. The analysis covered the significant association between the perception of the EMS providers with the availability of resources, availability of PPE, and level of competency in emergency response and institutional policies.

ETHICAL CONSIDERATIONS: Ethical approval was obtained from the institutional review Board (IRB) Committee and was approved according to ICH GCP guidelines (September 17, 2020) to ensure patient safety and conduct of high standards ethical research. The questionnaires administered were reviewed by the relevant experts before being administered to the participants. Participants were provided with study information including its purpose, the nature of voluntary participation. They were assured a written informed consent to participate, and their responses were anonymous and may be

published without any personal information to protect their confidentiality. Identification information was only accessible to the authors. The data was used under strict confidentiality and only for the research question.

RESULTS

As shown in Table 2, out of the 276 participants, the EMS section in Makkah was dominated by males, who accounted for 96%, while there were only 4% female practitioners. Concerning age, 18 to 24 years, 25 to 34 years, 35 to 44 years, 45 to 54 years, and ≥65 years were 13%, 59%, 26%, 2%, and 0.4%, respectively. When evaluated based on provider level, the majority of the participants were EMT and paramedics

accounting for 44% and 43%, respectively, while the respiratory therapists were the minority with 0.4% and EMS registered nurses represent 5% while EMS doctors 4%. Forty-five per cent of the participants have worked as EMS providers for more than 6 years, 19% have worked between 4 and 6 years, 22% have worked between 1 and 3 years and 14% have worked for less than 1 year. Red Crescent had the most EMS providers with 59% of the participants working there, followed closely by the Ministry of Health at 27%, while private hospitals, military institute, academic institute, and other institutions followed at a distance with 8%, 3%, 2% and 1% of the total workforce, respectively.

Health care workers' awareness about dealing with COVID-19 crisis and their satisfaction with the hospital's response: As mentioned in Table 3, when assessed on whether they received COVID-19 specific training from their agency, 19% admitted to having received the training, 46% received the training but expressed it as limited, while 26% did not receive any training. Forty-four per cent of the practitioners worked for more than 40 hours per week on COVID-19 cases, 6% worked between 15 and 20 hours, 12% worked between 10 and 15 hours, and 4% worked for less than 5 hours. With regards to benefits accorded for being responders to the pandemic, 70% did not receive any reward, while those who were given a paid leave, hazard pay off, family and medical leave, and other rewards were 3%, 2%, and 7% respectively.

The table shows that 34% of the participants were satisfied with their institution's response to the pandemic, 21% were dissatisfied, 13% very dissatisfied, 14% very satisfied, while 19% were neither satisfied nor dissatisfied.

AVAILABILITY OF RESOURCES: As presented in Table 4, concerning the availability of resources, 82% affirmed that they get access to gloves when they need them, 42% get access to N95 masks when they need them, 33% did not have access, while 15% were not sure. Seventy per cent of the participants did not have access to disposable stethoscopes, while only 11% had access to them.

According to Table 5, there was a significant relationship between the EMS providers who had access to gloves and their provider level of EMS as the majority of the providers were EMTs and paramedics ($P=0.001<0.05$). The study also established a significant relationship between the place of work and EMS providers who had completed the COVID-19 specific training, those who had access to N95 masks, and

those who were satisfied with their institution's response to the pandemic. (P<0.05). Conversely, there was no significant association between gender, age, and the availability of resources and PPE.

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DISCUSSION

In this study, sex and age were not associated with the availability of resources and PPE. The availability of these resources is dependent mainly on the place of work and the institution's policies. These findings are consistent with those of a previous study conducted in the US that also found a significant association between the availability of resources and institutional policies.[30] Similar to the results of the same

study,[30] the availability of N95 masks was found to be limited in this study. This also reflected the shortage of resources pertaining to the pandemic.

Place of work and COVID-19 specific training was associated in this study, as were the provider's experience and the replacement of N95 masks. Most of the participants reported limited training. This shows the necessity for proper training for health care providers.
Unquestionably, these situations demand more manpower in a short time, but better guidelines and targeted training can guarantee improved results. These results are consistent with the findings of a previous study that reported that training and the availability of PPE and N95 masks were associated.[31] The previous study concluded that most of the training was limited due to the fact that some personnel were employed part-time, worked in rural settings, or were trained to respond to 911 emergencies.

The emergency department sanitation practices, institutional policies, and provider demographics were associated in this study. Institution policy plays a crucial role in ensuring that the COVID-19 protocols on safety are effectively executed. The availability of the guideline protocols ensures an effective system and provides a mode of action in such situations. This also saves a considerable amount of time that would otherwise be wasted on errors and their correction. These policies reduce the errors based on negligence and unforeseen circumstances. Along with saving time and a smooth course of action, they also decrease the number of undesirable outcomes for the patients including complications. A previous study regarding COVID-19 pandemic consensus guidelines for preferred practices in esthetic clinics stipulates procedures and preferred practices that should be enforced to protect staff and prevent further disease transmission.[32] The implementation of consensus guidelines has been reported to have a significant effect on protecting staff, and the guidelines are best implemented by hospitals or institutions, as the management is usually qualified and hardworking.

In this study, there were no associations between sex and the general perception of facility preparedness, the media's portrayal of COVID-19, or the comparison between the flu and the coronavirus. However, there was a significant relationship between sex and the perception of an increased risk of illness due to exposure to COVID-19.

An important association was found between the availability of COVID- 19 protective equipment, such as gloves and N95 masks, and the place of work. This indicates the significance of the role and responsibility of the institutes to provide the necessary equipment to the staff. This is directly associated with provider satisfaction and indicates the significance of resources allocated for the equipment by the medical department and hospitals as the place of work. Provider satisfaction in turn ensures the efficiency of emergency medical services and greatly improves the outcomes.

Provider experience was associated with the perception of preparedness and place of work. The clinicians and related staff are directly affected by these parameters as they are major stakeholders in this case. The level of preparedness and the workplace

environment can greatly enhance or decrease the quality of service. This study found that approximately one-third of participants were satisfied with their institution's response to COVID-19, which is similar to the findings of a previous study regarding the perception of the response to natural disasters and disease outbreaks.[33] Most participants in this study expressed concern regarding the well-being of their family members, though no associations were found between participant demographics and attitude when responding to emergencies.

LIMITATIONS

This study had some limitations. The response rate was low, and this may have caused a selection and response bias. Also, the sample size was small, despite the convenience sampling method used. In addition, most of the participants were male. These study features limit the generalization of the results. Misclassification of cases may be present as we depended on self-estimation and reporting of PPE. Our sample was also limited to recertify, nationally certified EMS personnel. So, our results may not be generalized to all the EMS community. Although we chose the initial dissemination of the CDC's EMS guidelines as the model's interruption, the COVID-19 pandemic is a dynamic situation in which there may not be a single time point that best depicts the EMS community's response. Best practices for PPE are still being debated, and we can't say for sure whether the improvements seen were due to the information offered.

CONCLUSION

This study found an association between the place of work and the availability of resources and sanitation methods during the COVID-19 pandemic in Makkah. The results of this study indicate that the perceptions of EMS providers toward COVID-19 are significantly influenced by the place of work, availability of resources, COVID-19 specific training, and provider experience. Therefore, institutions should adopt guidelines that stipulate care for patients with COVID-19, provide training to emergency personnel, and properly distribute resources and PPE.
This current emergency situation should be an eye-opener for the governments and health departments, focusing on relocating the necessary resources and on emergency medical services. The pandemics should be treated as an opportunity to develop the emergency departments for all such future instances, enable the pre-emptive tackling of such events and the full preparation for times of crisis.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and

country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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Table 1: Inclusion and Exclusion Criteria

Parameters	**Inclusion**	**Exclusion**
The geographical location of the study	All around Makkah city	Cities other than Makkah
Participant's specialty	Paramedic EMT Emergency physician Emergency nurse	Any other medical specialty
Participant's exposure of interest	Medical Prehospital transportations of positive COVID-19 cases	Non-COVID-19 medical Transportations, Non-medical transportations

Table 2: Demographic Data Description

		n	***Percentage***
Gender	Male	264	96%
	Female	12	4%
		276	

Age group	18-24	36	13%
	25-34	162	59%
	35-44	72	26%
	45-54	5	2%
	65+	1	0.4%
	276		
Provider Level	Emergency Medical Technician	122	44%
	Paramedics	119	43%
	Respiratory Therapist (RT)	1	0.4%
	EMS registered nurse	13	5%
	EMS doctor	12	4%
	Other	9	3%
	276		
Years worked as an EMS provider	Between 1-3 years	61	22%
	Between 4-6 years	52	19%
	Less than 1 year	39	14%
	Longer than 6 years	124	45%
	276		
Place of work	Academic Institute	6	2%
	Military Institute	7	3%
	Ministry of Health	74	27%
	Private Hospital	22	8%
	Red Crescent	163	59%
	Other	4	1%
	276		

Table 3: COVID 19 related practices

Completed COVID-19 specific training by your agency		n	percentage
Benefits awarded as a response to the COVID-19 pandemic	Yes, extensive	51 12	19%
	Yes, but limited	6	46%
	No	71	26%

Hours of sleep on average you get every night	Family and medical leave	19	7%
	Paid time off	9	3%
	Hazard pay off	6	2%
	Did not receive any awards	194	70%
	Others	20	7%
Total week-hours of work dedicated to COVID-19	1-3 hours	6	2%
	3-5 hours	75	27%
	5-7 hours	129	47%
	7 + hours	38	14%
A condition that deems you immune	Less than 5 hours	11	4%
	5-7 hours	10	4%
	7-10 hours	15	5%
	10-15 hours	32	12%
	15-20 hours	17	6%
	20-40 hours	4112	15%
	Greater than 40 hours	2	44%
Anyone in your household over 65 years of age?	Yes	621	2%
	No	4	76%
	No (not sure)	28	10%
Anyone in your household over 65 years of age?	Yes	55	20%
	No	0	58%
	Not sure	33	12%

Table 4: Availability of resources and sanitization practices

Access to gloves when needed		***n***	***Percentage***
	Yes	225	82%
	No	9	3%
	Not sure	14	5%
Access to N95 masks when needed	Yes	117	42%
	No	91	33%
	Not Sure	40	15%
Are disposable stethoscopes available for use	Yes	30	11%
	No	194	70%
	Not sure	18	7%

Table 5: Demographic status cross availability of resources, availability of Personal Protective Equipment (PPE)

Demographic status cross Availability of resources	Completed training by agency P-value	Have access to gloves	Have access to N95 masks P-Value	Overall institution response to the pandemic Pvalue
Gender	0.916	0.390	0.206	0.199
Age	0.502	0.711	0.668	0.112
Provider level	0.349	0.001*	0.485	0.186
Years of experience	0.144	0.452	0.372	0.084
Place of work	0.039*	0.809	0.000*	0.000*

*P value= <0.05

Table 6: Demographic Status Cross practices of emergency medicine sanitation, institutional
Policies

Demographic status cross availability of resources	Disinfecting EMS compartment after returning from a call P-value	Disinfecting stethoscope after returning from a call P-value	Access to the disposable stethoscope	How often is the N95 mask replaced
Gender	0.017*	0.228	0.266	0.333
Age	0.204	0.324	0.252	0.062
Provider level	0.598	0.029*	0.597	0.222
Years of experience	0.027*	0.095	0.230	0.007*
Place of work	0.000*	0.002*	0.016*	0.046*

* -P value= <0.05

Table 7: Demographic Status Cross perception among EMS professionals regarding responding to COVID-19 pandemic.

Demographic status cross perception of EMS	Common cold is an example of Covid 19 P-values	Am I at? increased risk for severe illness due to exposure to	COVID-19 is not as bad as the media portrays it	My facility was prepared to respond effectively to

professionals		COVID-19?		the COVID-19 pandemic
Gender	0.921	0.005*	0.567	0.299
Age	0.218	0.530	0.082	0.471
Provider level	0.422	0.001*	0.283	0.609
Years of Experience	0.505	0.339	0.422	0.036*
Place of work	0.898	0.821	0.350	0.000*

* -P value= <0.05