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Healthcare system resilience and risk communication strategies during the COVID-19 pandemic in Madinah, KSA: A mixed-method study

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ABSTRACT

Objective: This study aimed to assess the resilience of the healthcare system regarding preparedness and response to COVID-19 and to identify risk communication strategies during the pandemic in Madinah region.

Methodology: Mixed method explanatory sequential design was used in this study, that was carried out between January to October 2021 in Al Madinah region, Saudi Arabia. A total of 41 health managers participated to gather quantitative evidence regarding challenges of health care system in pandemic. The qualitative inquiries were incorporated through in-depth interviews of primary and tertiary care managers.

Results: Majority of the participants 82.9% (n=34) had been dealing with COVID- 19 pandemic. Around 85% (n=35) of the health managers agreed that all relevant health sectors were involved in the risk assessment. It was found that 90.2% (n=37) agreed to the availability of early warning systems to be an effective means of risk communication using text messages and digital apps. Only 61% (n=25) of participants knew that preparedness and response could be evaluated, in contrast to interview findings of continuous audit of healthcare system. Qualitative findings reaffirmed efficient "risk communication" throughout the pandemic while "engagement of community" was at its best in its second wave.

Conclusion: The healthcare system was found to be adequately prepared to cope with the challenges during pandemic, as evident by sufficient awareness and implementation of emergency response, risk communication and community involvement among health managers. Moreover, qualitative data reaffirmed the findings of numerical data with disagreement on evaluation methods domain. Qualitative findings further reinforced the shifting roles of primary and tertiary care in making the health systems more responsive during COVID-19 pandemic.

KEY WORDS: Healthcare system, COVID-19 Pandemic, Resilience, Risk Communication.

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INTRODUCTION

The response of healthcare systems plays an indispensable role in promoting health and limiting disease in populations by means of surveillance activities and communicating risks to populations through resilience of its systems.[1,2] Resilient systems have been defined as those that rapidly acquire information to changing circumstances, quickly adapting their behaviours and structures, and communicate easily and thoroughly with others. Various efforts had been taken in the past to improve response during a public health emergency.[3-5] At the time of the COVID-19 pandemic, the Health Emergency and Disaster Risk Management (EDRM) framework was in place to deal notably through community capacities.[6,7]

An international response to COVID-19 was testified at the start of the pandemic but ineffective due to a delay in rapid response.[5] In February 2020, a robust Strategic Preparedness and Response Plan (SPRP) for COVID-19 was introduced by WHO to focus on eight pillars

including that of risk communication and community engagement which provides the general public with appropriate messages.[2] Additionally, other tools were also introduced by WHO to cover many aspects of disaster and risk reduction.[8,9]

In accordance to the disaster framework during the early waves of the pandemic, disruptions to almost half of essential health services was reported. The 'collateral damage' to non-COVID activities as a result of hospital COVID preparedness has been observed, notably with the loss of elective operations and outpatient care. The important gaps in preparedness were counted as lack of surge capacity, and weaker links between public health and the healthcare systems.[10] Even healthcare systems with adequate preparedness were still badly affected, either as a result of inadequately trained health workers, insufficient awareness of COVID-19, higher demand of essential supplies, or psychological and physical burnout of staff.[11]

The capacity of countries for their preparedness for epidemics and pandemics in 2021 was measured as Global Security Index of 38.9, the global preparedness-response 46 and 19 for community engagement and risk communication. Saudi Arabia, also faced difficulties due to a lack of preparedness and prompt response during the early phase of the pandemic. The security index score for SA was 61.2, while 33.4, 52.1, and 32.7 for risk communication, preventing emergency, detection and response operation respectively.[12]

It was important to assess health systems' potential to respond to health emergency and its prevention in our country by showcasing the evidence from Madinah region during the pandemic by using EDRM framework. The objectives were to determine the resilience of the healthcare system by assessing health manager's knowledge and their opinion and further to explain the measures of risk communication, community engagement through in-depth interviews of the senior managers in this study.

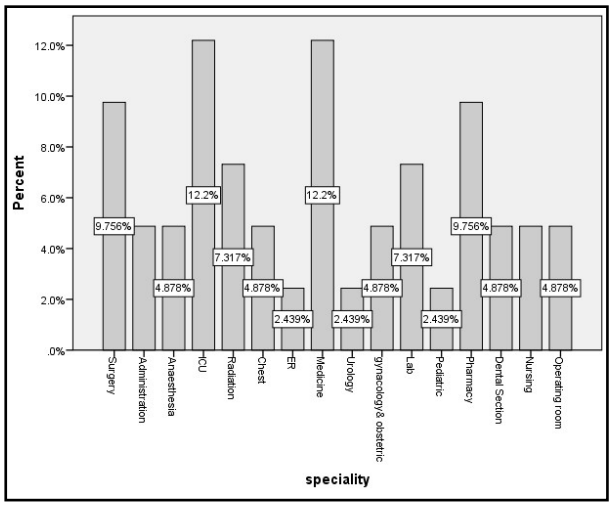


Fig.1: Workplaces of the study participants.

METHODOLOGY

This study was phase-2 of the longitudinal project on COVID-19 dynamics and control strategies, carried out between January to October 2021 in Al-Madinah region, Saudi Arabia. A mixed method explanatory sequential approach was adopted. The quantitative data was collected through self-administered questionnaire from 48 health managers in five designated government hospitals of Madinah region, namely Ohud, Meeqat, Madinah General, Yanbu, and Khyber with a response rate of 85.4%. A purposive sampling method was applied; each unit in-charge of the hospital was contacted to fill data form on EDRM framework.[6]

Later, face to face in-depth interviews were conducted from two senior health managers, representing primary and tertiary health care. The findings of quantitative survey were integrated through "following a thread" technique by introducing an explanatory topic guide of risk strategies during early and late waves, the impact of COVID-19, learned examples of resilience and the role of symbolism towards public response. The interview was 90-100 min in duration and was repeated once on Zoom for clarity and approval by the senior managers. The COREQ checklist was used to validate the reporting of responses.

Ethical Approval: Granted by IRB Madinah, under the decree of the General Directorate of Health (H-03-M-084; Date: October 15, 2020). Institutional consent of data collection was also granted by director of health, Madinah region. All participants provided a written informed consent and the confidentiality of information was maintained.

RESULTS

Out of the total study participants, 12.2% were working in the ICU and medicine departments, 9.7% in surgery, and 9.7% in the pharmacy (Fig.1).

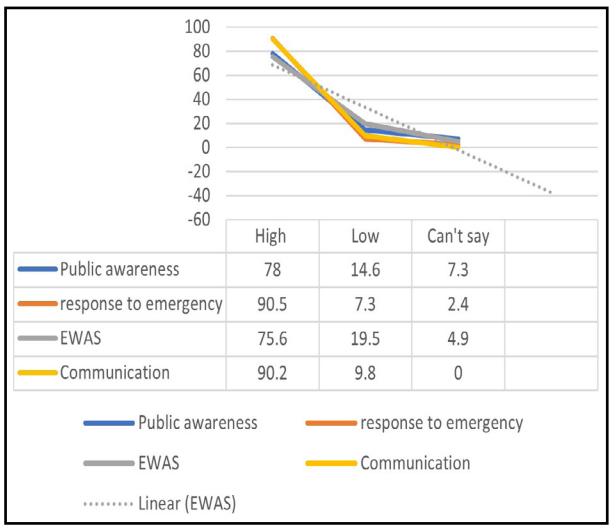


Fig.2: Opinion of health managers on level of achievement of risk communication measures.

Table-I: Awareness and experiences of health managers during the COVID-19 pandemic (n=41).

Questions	*Yes n (%)*	*No n (%)*	*Can't say n (%)*
Have you had direct professional experience of dealing in COVID-19 pandemic	34 (82.9)	7 (17.1)	0 (0.0)
Have you experienced any technological conflicts during it	17 (41.5)	22 (53.7)	2 (4.9)
Have you experienced any social conflicts during it	19 (46.3)	22 (53.7)	0 (0.0)
Have you experienced any administrative conflicts during it	16 (39.0)	24 (58.5)	1 (2.4)
Does a national policy exist on emergency preparedness & response against COVID-19 (such as laws, executive orders and ministerial decisions)	30 (73.2)	6 (14.6)	5 (12.2)
Is there any formal, multi-disciplinary emergency preparedness & response program for the health sector at our provincial level	26 (63.4)	9 (22.0)	6 (14.6)
Do we have developed a national, multi-disciplinary health emergency preparedness & response plan for COVID 19	36 (87.8)	5 (12.2)	0 (0.0)
Do we conduct regular simulation exercises at all relevant levels?	25 (61.0)	14 (34.1)	2 (4.9)
Do you abide by terms of reference, number of full-time staff and annual budget allocated for COVID-19, if available	25 (61.0)	10 (24.4)	6 (14.6)
Is there a full-time director/coordinator/focal point for COVID-19 preparedness & response at the central level of the Ministry of Health?	28 (68.3)	6 (14.6)	7 (17.1)

The majority of participants (82.9%) had a direct experience in dealing with the COVID-19 pandemic. Table-I. Some participants (14.6%) expressed the absence of a national policy and focal point from the MOH on emergency preparedness and response against COVID-19; whereas 22% and 12.2% said neither such

Table-II: Awareness of risk assessment programs and evaluation methods during the COVID-19 pandemic.

Questions	*Yes n (%)*	*No n (%)*	*Can't say n (%)*
Do we have hazard analysis & vulnerability assessment of COVID-19	23 (56.1)	9 (22.0)	9 (22.0)
Do we have public awareness programs on risks of COVID-19	36 (87.8)	1 (2.4)	4 (9.8)
Do we respond to emergencies and crises	36 (87.8)	4 (9.8)	1 (2.4)
Are there any early warning and alerting systems	32 (78.0)	6 (14.6)	3 (7.3)
Do we have communication systems	37 (90.2)	4 (9.8)	0 (0.0)
Are there competency or performance standards to assist in the development of training for COVID-19	34 (82.9)	3 (7.3)	4 (9.8)
Are all relevant health sectors involved in the process	35 (85.4)	1 (2.4)	5 (12.2)
Are hazard maps developed at the national level	32 (78.0)	5 (12.2)	4 (9.8)
Are hazard maps developed at the provincial levels	28 (68.3)	4 (9.8)	9 (22.0)
Is there an evaluation or audit method for assessing the effectiveness of the health sector emergency preparedness & response?	25 (61.0)	7 (17.1)	9 (22.0)
Is the health sector emergency preparedness & response programe benefiting from international programs?	30 (73.2)	5 (12.2)	6 (14.6)
Are NGOs involved in the COVID-19 emergency preparedness and response?	26 (63.4)	3 (7.3)	12 (29.3)

a program on the provincial level, nor a plan against COVID-19, exists, respectively. It was found that 39%, 41.5%, and 46.3 % of participants faced administrative problems, technological difficulties, and social conflicts, respectively during the pandemic. Sixty-one percent approved that simulation exercises for emergencies were conducted at various levels.

The presence of awareness programs for the public on risks of COVID-19 (87.8%), availability of early warning and alert systems (78%), communication systems (90.2%), and performance standards needed for COVID-19 training (82.9%) is depicted in Table-II. It was further noted that all relevant health sectors were involved in the risk assessment and management process (85.4%), and hazard maps developed at the national level (78%). When evaluating emergency preparedness and response to COVID-19, 61% of the participants agreed that it is assessed for effectiveness.

Table-III shows that 82.9% and 85.4% of managers were aware of the emergency preparedness and response guidelines, and the availability of control arrangements, respectively. Nearly 88% agreed that there is a description of roles and responsibilities of all health sectors. The majority were aware of the existence of logistic platforms and emergency information systems (85.4%), emergency training courses (70.7%), and about measures to prepare healthcare facilities to protect from COVID-19 (85.4%).

In response to questions on the level of achievement of the COVID-19 measures 90.2% recognised achievement in emergencies and communication systems, and 75.6% identified warning and alerting systems as being adequately achieved (Fig.2).

Comparing responses of the participants, it was found that the administrative and ICU managers showed overall better awareness and understanding of all components of emergency risk management. It was noted that surgical and allied managers lack in knowledge regarding preparedness and response program at provincial level; While medical and allied lack in their understanding regarding COVID coordinator role and social worker role in containing the pandemic (Table-IV).

Only 3/5th of the participants reported that effectiveness of preparedness was assessed and recognized the role of NGOs in it. Though most of the participants were aware of the emergency information system of the health sector but only two-third recognized availability of emergency training courses for health personnel including social workers or health volunteers.

Findings of In-depth interviews: The senior managers from tertiary care hospital [AA] and from Primary care centre [AAJ] responded to specific questions during face- to- face interview. They explained and exemplified mechanism of risk communication, community engagement and response of health system during the pandemic by focusing on pillar 2 SPRP plan and also explained numerical data.

Interview started with general impact of COVID-19 pandemic. They responded that "*The lessons learned from the Middle East Respiratory Syndrome Coronavirus (MERS-CoV) epidemic helped Saudi Arabia to prepare effective strategies and control the pandemic sooner in comparison to other countries*." *[AA]*

Additionally, "*the relentless cooperation by the MOH during COVID-19 regarding public-private partnerships and adequate equipment supplies, lessened the burden of the pandemic on the healthcare system and improved the quality of medical services*".[13-15] *[AA]*

"*The primary healthcare burden had increased during the pandemic. Initially people were afraid but later they*

Table-III: Awareness of health sector plans, guidelines, and human resources during the COVID-19 pandemic.

Questions	*Yes n (%)*	*No n (%)*	*Can't say n (%)*
Are there health sector command and control arrangements made	35 (85.4)	4 (9.8)	2 (4.9)
Description of roles and responsibilities of all health sector	36 (87.8)	3 (7.3)	2 (4.9)
Do we have logistic platforms and emergency information systems	35 (85.4)	3 (7.3)	3 (7.3)
Do we take measures to protect from COVID-19 and prepare health care facilities	35 (85.4)	1 (2.4)	5 (12.2)
Are there formally accredited emergency training courses or institutions for health sector personnel	29 (70.7)	9 (22.0)	3 (7.3)
Are there country health emergency preparedness & response guidelines and other publications	34 (82.9)	5 (12.2)	2 (4.9)
Available job description	32 (78.0)	7 (17.1)	2 (4.9)
Training of physician and nurses for emergencies	33 (80.5)	6 (14.6)	2 (4.9)
COVID coordinators, social workers	26 (63.4)	12 (29.3)	3 (7.3)
COVID medical technicians	26 (63.4)	8 (19.5)	7 (7.1)

Table-IV: Questions used as basis of qualitative inquiry.

Questions	*Health Manager response*	*Overall fx (%)*	*Surgical & Allied [n=13]*	*Adminis-tration & ICU [n=15]*	*Medical & Allied [n=13]*
Have you experienced any technological conflicts during COVID-19 pandemic	Yes	17 (41.1)	7 (53.8)	6 (40)	4 (30.7)
Have you experienced any social conflicts during it	Yes	19 (46.3)	3 (23.1)	9 (60)	7(53.8)
Does a National Policy exist on emergency preparedness & response against COVID-19	Yes	30 (73.2)	9 (69.2)	12 (80)	9 (69.2)
Is there any emergency preparedness & response program for the health sector at our provincial level	Yes	26 (63.4)	6 (46.1)	11 (73.3)	9 (69.2)
Do we conduct regular simulation exercises at all relevant levels?	Yes	25 (61.0)	8 (61.5)	10 (66.6)	7 (53.8)
Is there a full-time director for COVID-19 prepared-ness & response at the central level of the MOH	Yes	28 (68.3)	10 (76.9)	11 (73.3)	7 (53.8)
Do we respond to emergencies and crises	Yes	36 (87.8)	11 (84.6)	15 (100)	10 (76.9)
Are there any early warning and alerting systems	Yes	32 (78.0)	9 (69.2)	13 (86.6)	10 (76.9)
COVID coordinators, social workers	Yes	26 (63.4)	9 (69.2)	11 (73.3)	6 (46.1)

cooperated fully by reporting through the Sehaty and Tawakkalna apps." [AAJ]

Many volunteers from colleges and universities took part in the mass screening and in the advocacy of preventive measures. PHC staff supervised the quarantine of patients and provided their follow-up." *[AAJ]*

Responding to the question about administrative problems, they responded: "*The major problem during the pandemic was preparing ICU units adequately and training health-care workers for the expected caseload surge in the initial phase. The situation was further complicated by psychological challenges and fear among health worker, reluctance to comply with duties by junior doctors and also maintaining a standard staff ratio of qualified professionals. Front-line workers suffered from higher levels of stress, exacerbated by their families avoiding them due to their exposure during hospital duties.*". [AA]

Responding to the query about national command and control activity, it was described that "*The COVID-19 pandemic called for urgent support to the most affected areas in the country through the application of telemedicine and other administrative services. During the pandemic, the intensive care unit (ICU) staff from the private healthcare sector were deployed to support national critical care services and overcome a shortage there. The National Emergency Committee was highly active throughout and took decisions under the direct supervision of the health minister. Similarly, the tele-ICU command centre was of great help and provided experts' clinical guidance and consultation*." *[AA]*

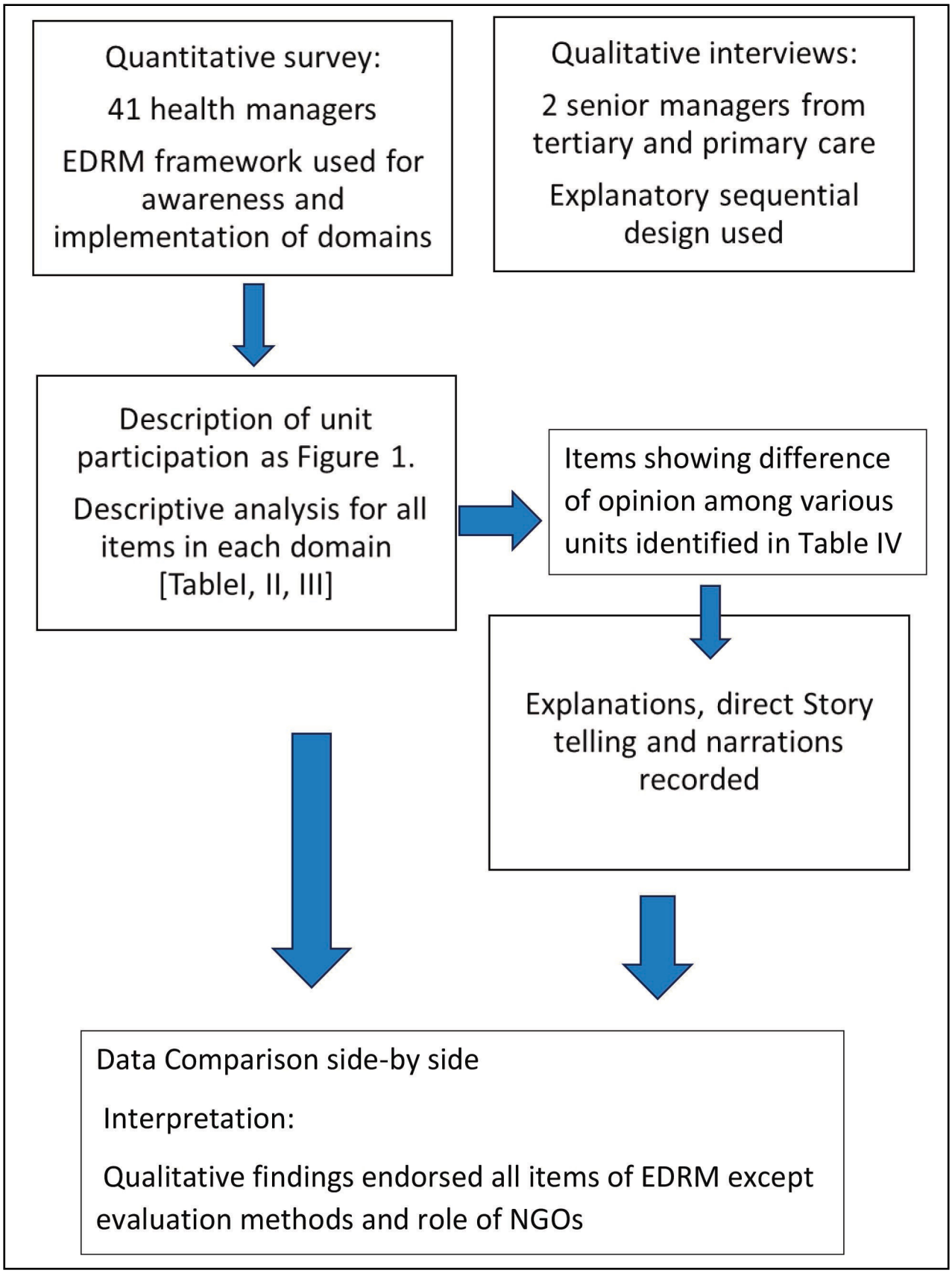
Regarding query on risk communication and related strategies, they told "*The primary healthcare functions were moderated through the public health department of the MOH and helped raise community awareness regarding the mode of transmission of COVID-19 and control measures. As expected, the common disease reporting and delivery of care was reduced in the early lockdown phase. Staff were trained online regarding infection control and efforts were reinforced to implement infection control measures. Health surveys were also conducted under PHC for some residential neighbourhoods during the pandemic for high alert areas."[AAJ]*

Additionally, "*primary health care function was extended to supervision of the COVID-19 testing laboratories and vaccination*." *[AAJ]*

"*The MOH has tried several strategies for improving the management of public hospitals during the COVID-19 pandemic, including direct operation by the MOH, partial or comprehensive operation by healthcare companies, and transfer COVID-19 cases to transition centre*." The senior manager mentioned that "*the preventive measures to reduce the spread of COVID-19, included the reduction in elective surgical operations, the decision to prevent the entry of 2.5 million pilgrims [safe Haj 2020], mass screening and widespread implementation of hand hygiene around Saudi Arabia that resulted in a considerably reduced number of critical cases and deaths*."

"*The MOH's leadership was commendable, and communicated the COVID-19 situation rigorously via TV, radios, text and WhatsApp messages. Assessment of suspected and confirmed cases was made possible through electronic applications such as "Tetamman", "Sehaty" and "Mawid" and the 937 hotline was used for public information*."

Community engagement activities and strategies were mentioned as: "*The slogan, "We are all responsible" [in Arabic كلنا مسؤول], encouraging people to be involved actively. By strictly following the guidelines, the community helped the state succeed in its fight against the disease in Saudi Arabia*." *[AA]*


Quantitative survey:
41 health managers
EDRM framework used for awareness and implementation of domains
Qualitative interviews:
2 senior managers from tertiary and primary care
Explanatory sequential design used
Description of unit participation as Figure 1.
Descriptive analysis for all items in each domain [TableI, II, III]
Items showing difference of opinion among various units identified in Table IV
Explanations, direct Story telling and narrations recorded
Data Comparison side-by side
Interpretation:
Qualitative findings endorsed all items of EDRM except evaluation methods and role of NGOs

"*Importantly, awareness campaigns were organized to urge citizens to stay at home and home-delivery of medicines was initiated in pharmacies*." *[AA]*

"*Primary health care centres offered many educational and training activities during the pandemic to engage the communities and communicate risk to both healthcare providers and healthcare recipients*." *[AA]]*

"*The Saudi people cooperated well and the involvement of high-cadre health officials in daily campaigns, also played a vital role in changing the societal behaviour positively*." *[AA]]*

They suggested that "*drill, advance training of health-care staff, better utilization of tele-ICU"[AA]*, and "*distribution of nursing staff, vaccinators, or support staff needed to deal meticulously with emergencies*." *[AA]].*

The interviews clearly identified the role of COVID coordinators and provided the evidence on assessment of emergency response of health sector.

DISCUSSION

The health managers awareness was found to be sufficient regarding emergency response, risk communication and community involvement, but lacking on evaluation methods and involvement of NGOs.

Moreover, less than half of the participants faced administrative (39%) and technological difficulties (41.2%), particularly those working in the ICU, a trend also recognized in a Belgian study.[16] A study in Nepal revealed contrasting findings, where participants were not sufficiently confident about hospital policy to receive COVID-19 cases and 94.7% identified an inadequate supply of PPE.[17] In our study more than 80% of health mangers were aware of the emergency guidelines and protocols, while Ahmed N et al, reported it as a major deficiency in their study.[18]

The use of digital apps and text messages by MOH was explained as effective communication by 90.2% participants and 75% of public awareness in our study, similar to case studies of three countries in determining information system resilience.[19] In contrast, a study in Vietnam reported poor community hygiene and sanitation practices in a high-risk environment with limited public awareness.[20] Whereas, other studies identified lack of hospital beds and shortage of essential drugs and welfare services as responsible factors.[21,22] In addition, a large study also found that variability in disruptions to hospitalizations and ambulatory care across countries, during the pandemic may be due to limited number of healthcare workforce.[23]

Qualitative findings detailed out the various challenges, such as a deficiency of front-line workers, anxiety and fear and conflicts among workers in the early COVID-19 phase in Madinah, while a substantial proportion of health managers also reported same. These psychological ailments and disruption in work life balance also reported by few local and international studies.[24-26]

Interviews revealed that routine hospital inpatient and outpatient surgical practices were reduced, and surgical wards were converted to COVID-19 beds and other routine OPD was replaced by use of telemedicine. The international studies support the same observations that PHC staff were the front liners and dealt with triage, telemedicine, lack of admissions and referral of cases in several countries.[27-29] Other studies showed same trend, where respectively overall surgical care deescalated in 70% of hospitals, 64% in gynaecological, 25% in breast surgery and 55% reduction in paediatric surgery was reported.[30,31,11]

In depth interviews pointed out that, risk communication to the public was made possible by the effective use of mass media, electronic apps and volunteer service at primary care centres. A study also mentioned that the primary health centres modified their services to become preventive medical centres and therefore helped in curbing the situation.[32]

Our senior managers expressed that community engagement was higher in the second wave of the pandemic, as also noted in a local study that the compliance of people was improved over time.[33] Remarkable community engagement has also been evidenced by other countries using a variation of strategies, such as quarantine, and the deployment of community health workers or local leaders.[21]

Strength and Limitations: This study built its credibility with the publication of its first phase.[34] The current study findings are trustworthy, because our participants were unit in-charges from major departments in hospitals and senior managers from two tiers of health care system. The target population of the Madinah region was relatively narrower, and only designated hospitals were dealing with the burden of pandemic included here in this study. Acquiescence or self -reporting bias might be encountered in quantitative data but controlled well by applying specific technique in qualitative inquiry. Similarly, the possibility of response bias was minimal as it was a self- administered questionnaire and anonymity was ensured. Mixed method design was used to ensure authenticity and truth in the study. Smaller sample size can be a limitation as well along with lack of generalizability of findings.

CONCLUSION

The health systems in Madinah region showed adequate preparedness and response mechanism during the COVID 19 pandemic through timely interventions and control measures by ministry of health. The communication system, health care response and public awareness were considered as remarkable achievement in controlling the pandemic. The qualitative findings reaffirmed that the risk communication and community engagement were most effective measures in curbing the pandemic in Madinah. Certain disagreement was found between qualitative and quantitative findings regarding assessment of health care and role of coordinators in the emergency, as that was endorsed by senior managers and not by unit in-charge. This divergence may be due to difference in their level of management and specific exposures.

Recommendation: It is recommended that the induction of community health workers and better-trained volunteers would improve the response of the healthcare system in Saudi Arabia through advocacy measures during health emergencies.

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Authors' Contribution:

Study was conceived by **FAM, HMI;** Analysis and interpretation of the data was done by **MMZ, HMI;** Provision of study materials was by **HMI, AAA, FAM** and final approval of the article by all authors. **FAM** would be responsible for the accuracy and integrity of this research.