





## Evaluation of the online continuing education experience during the COVID-19 pandemic in a Middle Eastern ambulance service: A cross-sectional study

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### ABSTRACT

**Introduction:** The COVID-19 pandemic posed significant global challenges to healthcare systems, necessitating rapid education and training adaptations for frontline workers. In Qatar, Hamad Medical Corporation Ambulance Service (HMCAS) has transitioned to distance learning platforms to ensure the continuing professional development of paramedics. The aim of this study was to evaluate the effectiveness of these online learning platforms in meeting the educational needs of HMCAS paramedics in pre-hospital care.

**Methods:** A retrospective observational study design was followed using an online survey. Data were collected using a validated tool focused on accessibility, feasibility, and perception of online learning during the pandemic. Descriptive and inferential statistics (ANOVA) were used to estimate differences in satisfaction scores across themes and analyze the data.

**Results:** The findings revealed that HMCAS paramedics reported high levels of satisfaction (mean 3.93 out of 5) with online learning, citing its ability to meet their educational needs, enhance academic performance, and provide a safe learning environment. However, challenges such as poor internet connectivity, financial constraints, and lack of face-to-face interactions were identified as limitations. ANOVA results indicated that there was higher satisfaction with the online learning program, and that it met their patient care management expectations.

**Conclusion:** This study highlights the potential of online learning to meet the educational needs of paramedics during a global health crisis. The findings suggest that online learning can be an effective and resilient approach to education and training in future public health emergencies with appropriate quality control measures, improved feedback mechanisms, and strategies to enhance interaction and engagement.

**Keywords:** emergency medical services, pandemic, online learning, distance learning, education and training, paramedics

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## INTRODUCTION

The COVID-19 pandemic, caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has had a profound impact on global health and education systems since its outbreak in December 2019.<sup>1</sup> The rapid transmission of the virus through contact routes and respiratory droplets led to millions of infections worldwide, overwhelming healthcare infrastructures and necessitating urgent containment measures such as physical distancing, environmental disinfection, and COVID-19 case tracking.<sup>2,3</sup> Governments and healthcare organizations had to adapt to the crisis, with frontline workers facing unprecedented demands to comply with regularly updated clinical practices and safety protocols. The pandemic forced the closure of schools, colleges, and universities in the education sector, disrupting traditional face-to-face learning for over 1.5 billion students globally.<sup>4</sup> Educational institutions had to rapidly transition to remote and online learning modalities to ensure continuity of education while mitigating the spread of the virus. This abrupt shift posed significant challenges, particularly for students from disadvantaged backgrounds who needed access to digital infrastructures and resources.<sup>5</sup>

The healthcare sector, which relies heavily on continuing professional development and hands-on practical training to keep providers updated on clinical advances and skills, faced unique challenges during the pandemic.<sup>6</sup> With stringent containment and precautionary measures in place, traditional in-person education and training were suspended,<sup>7</sup> threatening the operational readiness of healthcare workers. This was particularly concerning for frontline paramedics, who were critical in providing pre-hospital emergency care and required training on COVID-19-specific management and safety procedures to effectively manage the surge in cases.<sup>6–8</sup>

In Qatar, Hamad Medical Corporation Ambulance Service (HMCAS) has a well-established training department and operates approximately 100 emergency response units, which under normal circumstances handle approximately 1,000 emergency calls per day.<sup>9,10</sup> However, daily emergency calls doubled during the pandemic, overwhelming effective service delivery with operational challenges, including staff infections and training and safety education delivery. Although education and training are considered critical to ensuring the safety of clinicians and patients, especially when transporting critically ill or infectious patients,<sup>11</sup> to mitigate transmission risks and enforce robust safety precautions, HMCAS suspended face-to-face education and training for paramedics and students, necessitating the adoption of alternative educational strategies to maintain operational readiness.

HMCAS and other sectors within Hamad Medical Corporation facilitated education and training through various distance learning platforms and hybrid approaches, with most learning taking place through a synchronous blended online process. This approach aimed to eliminate face-to-face contact, control the spread of the virus among essential healthcare workers, and ensure the continuity of professional development during the crisis.<sup>12</sup> At a national level, even medical conferences have moved to online delivery.<sup>13</sup> Although online learning is recognized as an effective educational tool, evidence suggests that its implementation can be challenging, particularly during a global health crisis.<sup>14–16</sup>

Despite the growing body of research into the impact of COVID-19 on education, more information is needed on the educational needs and effectiveness of online programs for paramedics. Because paramedics are normally deployed in the pre-hospital setting, their working environment and circumstances differ from those of most other healthcare professionals. This study aimed to address this gap by determining whether the use of an online learning platform was an appropriate strategy to address the educational needs of HMCAS paramedics during the pandemic.<sup>17</sup> Furthermore, the study aimed to provide an overview of the challenges and opportunities associated with online learning in the context of a global health crisis in the pre-hospital healthcare setting.

## METHODS

### Study design and settings

A retrospective observational study using an online five-Likert scale satisfaction survey was conducted to collect quantitative data to assess how HMCAS paramedics perceived online learning and its effectiveness and to determine the existence of any gaps. The data collection period was from September 1 to September 30, 2023. The study design followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.<sup>18</sup> Ethical approval for this study was obtained from the HMCAS Group Research Oversight Committee with the reference number AS 2023-380 on August 30, 2023.

Face validation was conducted for this study. Three experts in paramedical education and research with at least a master's degree in their field were grouped in three consecutive sessions on June 8, 22 and July 20, 2023. Based on their experiences, they were asked to discuss and agree that each version of the questions was clear and relevant to the study objectives. The meetings were conducted using Microsoft Teams<sup>®</sup>. Each session lasted 180 minutes. The final version of the survey was reviewed after the last session.

### Participants

The target population of the study included only HMCAS operational paramedics who joined before January 2020. During the COVID-19 pandemic, the HMCAS Training Department mandated that these practitioners complete all continuing education programs through online platforms. Staff were required to attend these mandatory online sessions via the Microsoft Teams<sup>®</sup> platform, which they could access from their devices with an access license key provided by HMCAS. Additionally, the hours spent in training were considered part of the staff's working hours since the sessions were mandatory. The target population in this study included all ambulance paramedics, critical care paramedics, operations officers, and clinical managers at HMCAS. HMCAS staff who were not clinically operational, all non-HMCAS paramedics, and HMCAS staff who joined after January 2020 were excluded from the study.

The prerequisites set for participants included participating in online learning during the COVID-19 pandemic and completing at least one of the four HMCAS mandatory course modules using an online classroom platform as a paramedic student at HMCAS. The compulsory modules of the HMCAS are cardiopulmonary resuscitation, medical, pediatric, and trauma emergencies.

The Slovin formula was used to determine the minimum required sample size for the assessment:<sup>19</sup>  $S = N/(1 + N \times a^2)$ , where  $N$  is the total population ( $N = 1,500$ ) and  $a$  is the error tolerance ( $a = 0.05$ ). The minimum number of participants required was 315 paramedics.

### Variables

The main variables of interest in this study were satisfaction with 1) knowledge about COVID-19 after it was initially announced, 2) safety precautions after the announcement of the pandemic, 3) personal protective equipment (PPE), 4) managing patients initially after the announcement of the pandemic, 5) meeting students' learning needs, 6) online learning effectiveness in infection controls, 7) online learning beneficial, 8) perception of online learning, and 9) practical skills. No potential confounders or effect modifiers were considered. Furthermore, the survey focused on the accessibility, feasibility, and perception of HMCAS paramedics regarding online learning.

### Data sources and measurements

The survey included 44 fixed-choice questions and one open-ended question. The fixed-choice questions varied from two to five answer formats, either on the Likert scale or the dichotomous scale. A five-point Likert scale was used for the majority of the questions.

Experts from the HMCAS Training Department validated the survey for content and face validity. It was also pilot tested before broader distribution to identify problems such as readability, understanding, interpretation, language issues, spellings, and layouts.<sup>20</sup> The pilot phase tested the distribution, capturing, reporting, and analysis of the survey to ensure system sufficiency.

### Bias

Strict anonymity and confidentiality were maintained throughout the study to address potential sources of bias. Participants were informed about the purpose of the study and their right to decline participation or withdraw from the study at any time. No participant was allowed to complete the study without signing an informed consent form in order to maintain high objectivity levels in the data collection and analysis process and to increase the reliability and validity of our findings.

### Statistical methods

Microsoft Excel-365<sup>®</sup> was used in this study.

Cronbach's alpha was determined to assess the internal consistency reliability of a scale of the tool used. To calculate Cronbach's alpha in Excel, the data was first organized with each item in a separate column and the participants' responses in rows. Second, the variance of each item was calculated and

the item variances were summed. Third, each participant's total score and variance were calculated for each response. Finally, Cronbach's alpha was determined using the formula (Cronbach's alpha =  $(k/(k-1)) * (1-(\sum \text{item variances})/\text{variance of total scores})$ ), where  $k$  is the number of items.<sup>21</sup>

Descriptive statistics were used in this study. The ANOVA test was used to assess the differences in satisfaction scores across the themes.

## RESULTS

### Demographic and reliability statistics

In the one-month period, 322 HMCAS personnel participated in the study, including 300 paramedics and 22 trainers. Among the participants, 82.61% ( $n = 266$ ) were male, 16.15% ( $n = 52$ ) were female, and 1.24% ( $n = 4$ ) preferred not to declare their gender. Most respondents were between 35 and 44 years old ( $n = 171$ , 55%). The participants had different ethnic backgrounds, nationalities, and years of professional experience. Table 1 summarizes the counts and percentages for demographic variables. The Cronbach alpha coefficient was 0.80, indicating a good reliability coefficient.

### Satisfaction data results

The mean scores in Table 2 suggest that most paramedics did not have adequate knowledge about COVID-19, safety precautions, and patient management immediately after the announcement of the pandemic. However, online learning was deemed to have met the paramedics' learning needs, with a mean score of 3.86 (standard deviation 1.32, variance 3.47) out of 5.

The ANOVA test results (Table 3) show statistically significant differences in the satisfaction scores across various themes related to online learning during the COVID-19 pandemic ( $F = 919.75$ ,  $p < 0.05$ ). The themes with the highest average satisfaction scores were "managing patients initially after the announcement of the pandemic" (mean = 4.56) and "practical skills" (mean = 4.43). In

**Table 1. Demographic statistics of the study participants.**

Variable	Categories	Count	Percentage
Sex	Female	52	16.15
	Male	266	82.61
	I prefer not to say	4	1.24
Age group (years)	20–34	72	22.36
	35–44	187	58.07
	45–54	52	16.15
	55 and above	11	3.42
Years of experience in Hamad Medical Corporation Ambulance Service	1–4	82	25.47
	5–9	117	36.34
	10–14	69	21.43
	15–19	30	9.32
	20 and above	24	7.45
Joining date	Before January 2020	67	20.81
	After January 2020	255	79.19
History of healthcare work experience before joining HMCAS	No	70	21.74
	Yes	252	78.26
History of online training before joining HMCAS	No	164	50.93
	Yes	158	49.07

**Table 2. Summary of the participants' responses to the satisfaction survey according to the theme of the question.**

Satisfaction variable	Mean	Standard deviation
1. Knowledge about COVID-19 after it was initially announced	4.21	0.70
2. Safety precautions after the announcement of the pandemic	4.24	0.85
3. Personal protective equipment	3.43	0.91
4. Managing patients initially after the announcement of the pandemic	4.56	0.69
5. Meeting student's learning needs	3.98	0.86
6. Online learning effectiveness in infection controls	3.91	0.81
7. Online learning beneficial	3.48	1.13
8. Perception of online learning	3.90	1.03
9. Practical skills	4.43	0.71

**Table 3. ANOVA test results of the participants' survey responses.**

	Groups	Count	Sum	Average	Variance
<b>Summary statistics</b>	Knowledge about COVID-19 after it was initially announced	322	1,357	4.21	0.49
	Safety precautions after the announcement of the pandemic	320	1,356	4.24	0.72
	Information about PPE	322	1,104	3.43	0.83
	Managing patients initially after the announcement of the pandemic	322	1,468	4.56	0.48
	Meeting student's learning needs	322	1,283	3.98	0.75
	Online learning effectiveness in infection controls	322	1,260	3.91	0.67
	Online learning beneficial	322	1,122	3.48	1.28
	Perception of online learning	322	1,256	3.90	1.07
	Practical skills	322	1,428	4.43	0.51
	<b>ANOVA</b>	Source of variation	df	F	p
Between groups		10	919.75	< 0.05	

contrast, the themes with the lowest average satisfaction scores were “information about PPE” (mean = 3.43) and “online learning beneficial” (mean = 3.48). These findings suggest that while paramedics were generally satisfied with their ability to manage patients and develop practical skills, they were less confident in the information about PPE and the overall benefits of online learning.

Additionally, data from the participant's responses to the open-ended question about any other perceived benefits related to this online learning program were analyzed and are summarized in [Table 4](#). The main themes that emerged were the characteristics of how effective they believed online learning was during the pandemic, including the availability of learning resources and materials, ease of use, involvement and interaction, support and control systems, feedback mechanisms, and time management.

## DISCUSSION

The pandemic has pushed educators to innovate and continue delivering training programs. Online platforms and the internet have played an instrumental role in a wide range of healthcare-related education and assessment interventions.<sup>22</sup> The findings of this study revealed several key insights that contribute to the understanding of online learning in the context of a global health crisis, particularly in the pre-hospital healthcare setting. One of the study's major findings is the strong correlation between online learning and paramedics' perceived improved academic performance during the pandemic. This finding is consistent with existing research that showed enhanced academic performance among students who participated in online classes during the pandemic compared to the pre-COVID-19 period.<sup>8,23,24</sup> The convergence of evidence from this study and previous research suggests that when implemented effectively, online learning can be a valuable tool for enhancing students' academic performance, even in the face of unprecedented challenges posed by a global health crisis.

The study also highlights the importance of student satisfaction in the success of online learning programs. The overall satisfaction of HMCAS paramedics was positively influenced by their participation in online learning programs during the pandemic, indicating that student satisfaction levels were high with online programs that catered to their learning needs and can therefore be fostered by well-designed and implemented online learning programs.

**Table 4. Summary of thematic analysis of participants' responses to the open-ended question about the perceived benefits of online learning.**

Characteristics	Number of responses
Support resources	280
Involvement and interaction	300
Time management	290
Resources, pre-recorded, and live recordings	300
Feedback mechanisms	100
Support systems	300
Ease of use	289
Availability	310

The effectiveness of online learning in meeting students' learning needs during the pandemic is another key finding of this study. HMCAS paramedics found online learning effective during the pandemic, as it provided a safe means to continue their education despite the health crisis. Similar research has found that psychological safety and knowledge sharing in an online learning environment positively influence learners' perceptions of web-based learning. In the context of the pandemic, where paramedics and tutors faced health risks, reducing physical contact through online learning enhanced the safety needs of students and contributed to their perception of online learning as effective in meeting their needs.<sup>25,26</sup>

The study also revealed that online learning improved paramedics' abilities for personalized academic interaction and facilitated their understanding of course concepts. This is consistent with other studies, which found that students considered online learning effective during the pandemic due to its ability to facilitate student–teacher interaction.<sup>27</sup> The personalized nature of online learning allowed learners to ask questions and receive timely feedback on course concepts, thereby enhancing their learning experience.

Furthermore, the participants in this study emphasized the importance of continued learning due to the need for physical distancing. Online learning provided a means to overcome these barriers, making education accessible to learners during a major health crisis.<sup>6</sup>

In addition, the study provides evidence that online learning provided cost-effective learning and teaching opportunities for paramedics during the pandemic. By participating in online classes from home, paramedics could reduce their education-related expenses, such as costs of driving their personal vehicle or using public or private transportation. For organizations, this can reduce teaching facility-related costs such as electricity, water, and housekeeping, which would have been incurred if hundreds of learners had used the classrooms to attend face-to-face training courses.

The study found that online learning was effective when robust control mechanisms were in place to ensure the quality of learning, engagement, and dialogue between paramedics and teachers, as demonstrated by similar research.<sup>28</sup> However, the study also acknowledges the challenges encountered in online learning during the pandemic, such as poor internet connectivity, initial costs, isolation, and lack of face-to-face interactions.

## LIMITATIONS

Several limitations were identified during this study. Online learning during the COVID-19 pandemic negatively impacted paramedics' ability to meet their engagement, involvement, and academic needs. One of the most significant limitations was poor visibility and audibility of video content and live recordings, which were also identified as challenges by 100 participants, making it difficult for them to comprehend the content of the online training program. Another limitation for 90 participants was financial constraints, as they had to acquire learning devices for the online training programs. The initial cost of participating in online learning programs places burdens on these paramedics. Finally, there was a lack of internet availability, which affected 80 participants. Additionally, another study related to the higher levels of anxiety caused by the pandemic among paramedics in Qatar found that some participants reported feeling isolated due to the lack of face-to-face interactions. This further contributed to physical and mental health challenges. To address these limitations and improve the effectiveness of future online learning programs, participants suggested implementing better feedback mechanisms and quality control measures.<sup>29</sup> The latter could have helped prevent issues related to the quality of video and audibility, which would have enhanced their learning experience.

## CONCLUSION

This study provided perspectives on the effectiveness of online learning in meeting the educational and training needs of HMCAS paramedics during the COVID-19 pandemic. The findings show a strong correlation between the effectiveness of online learning and its ability to address the learning needs of paramedics related to the pandemic, supporting the expansion of online learning as a tool for enhancing the accessibility of education for paramedics in remote areas, particularly during times of global health crises when physical or face-to-face activities are restricted.

The study also highlights the perceived positive impact of online learning on academic performance, student engagement, and overall satisfaction. This suggests that well-implemented online learning can effectively improve paramedics' engagement, performance, and satisfaction with the learning process. Therefore, educational institutions should consider implementing online learning programs tailored to

the needs of their students. By investing in the development and optimization of online learning programs, educational institutions and healthcare organizations' training departments can ensure that they are well prepared to meet the evolving needs of their students in an increasingly digital world.

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### CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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