Original Article

Effectiveness of virtual training for medical officers and community health officers in the critical care management of COVID-19 patients in the intensive care unit

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ABSTRACT

Background and Aims: The coronavirus disease -19 has changed various aspects of education and training in all fields, and e-learning has now become the preferred mode of training and teaching. The aim of this study was to assess the impact of online training and to overcome the limitations of e-learning. **Methods**: A total of 176 medical officers (MOs) and 720 community health officers (CHOs) were trained in four batches by using seven training modules with online videos and lecture series. Each batch received two days of training. A pre-test and post-test were conducted which consisted of 25 multiple-choice questions of 4 marks each. There was no negative marking. Candidates obtaining >80 marks were declared as having passed. The results of the pre-test and post-tests were compared. **Results**: There was remarkable improvement in the knowledge regarding critical care management after virtual training, as evidenced by the test results. None of the MOs scored more than 80% in the pre-test; however, 153 MOs scored more than 80% in the post-test. The average score improved from 47.82 (pre-test) to 89.05 (post-test). The difference was statically significant ($P < 0.0001$). Similarly, 123 CHOs scored more than 80% in the pre-test, while 378 CHOs scored more than 80% in the post-test. Improvement in average marks was also seen: 90.5 in the post-test as compared to 62.76 in the pre-test. The difference was statically significant ($P < 0.0001$). **Conclusion**: Online training is beneficial for many candidates from various locations within a short period. The interactive sessions after training are also helpful, and well-designed pre- and post-tests are adequate for assessment.

Key words: COVID-19, intensive care, online learning

INTRODUCTION

Critical care management in developing countries, especially in rural areas, is challenging.[1-4] The coronavirus disease (COVID)-19 pandemic has provided the opportunity for healthcare workers to learn new things and develop new methodologies for training. The advantage of online teaching and training is that several people from very distant locations can be taught at the same time. The Department of Anaesthesiology of King George's Medical University, Lucknow in collaboration with the National Health Mission of our Government designed a virtual training programme for critical care management of COVID-19 patients in the intensive care unit (ICU). The targeted candidates were medical officers (MOs) and community health officers (CHOs) from various community healthcare centres (CHCs). Healthcare workers at CHCs are the backbone of India's rural health schemes, and they are actively involved in the management of patients

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with COVID-19 at every level, including treatment as well as vaccination services.

A study that assessed the role of accredited social health activists in improving equity in perinatal health across socioeconomic groups in India reported that building relationships, counselling and providing practical support had a positive influence on preparedness for birth and institutional delivery.[5] Similarly, MOs and CHOs can be useful in COVID-19 management if they receive optimal training. The training provided by our university focused on the critical care management of patients and was aimed at MOs and CHOs of provincial health services to enable them to start high dependency units (HDUs) and ICUs at their CHCs, thereby improving ICU bed availability for sick patients and reducing the time needed to initiate patient treatment by being able to provide comprehensive care at the rural level. Thus, the primary aim of our observational study was to evaluate the effectiveness of our online training programme, with the secondary objective of identifying and resolving the limitations encountered during the online training and teaching modules.

METHODS

The trainees included MOs and CHOs posted in various primary healthcare centres (PHCs) and CHCs in Uttar Pradesh. The training programme was conducted by the faculty of the Department of Anaesthesiology of King George's Medical University, Lucknow [Uttar Pradesh]. Training modules and questionnaires were prepared by the authors, and training was given by all faculty of the department. The purpose of this training was to prepare the MOs and CHOs posted in various districts for the ICU management of critically ill patients suffering from COVID-19. The MOs in the PHCs and CHCs held M.B.B.S. degrees or postgraduate degrees or diplomas for a speciality in the medical or health sciences from universities recognised by the National Medical Commission. Eligible candidates with General Nursing and Midwifery, B.Sc. Nursing, or Post-Basic B.Sc. Nursing degrees from a recognised institute or university were appointed as CHOs. This was a pre-approved training programme by the National Health Mission of Uttar Pradesh government during the second wave of COVID-19. It was mandatory training and hence, no institutional approval was required.

Bi-weekly planning was performed in collaboration with the National Health Mission. The training lasted for two days and was conducted on Fridays and Saturdays; the training spanned from 4th June to 26th June, 2021. The first MOs training session conducted on 4th and 5th June 2021 comprised of 176 MOs, and the 720 enroled CHOs were further divided into three batches [Table 1].

Teaching and training were provided online via videos and lectures on Zoom, I-cloud and Google Meet. Seven modules were designed for the MOs that included the following topics: ICU admission criteria and COVID-19 management protocol, oxygen therapy and non-invasive ventilation, airway management, basics of mechanical ventilation, infection control, management of sepsis and fungal infections, and nutrition and blood sugar management.

The modules for CHOs included the following topics: management of COVID-19 patients in the ICU, nursing care in the ICU, oxygen therapy in COVID-19 patients, arterial blood gas sampling and preparation of vasopressors, prevention of infection, counselling of healthcare professionals and dead body disposal. The pre-test and post-test questionnaires were prepared by the authors separately for each batch and each test consisted of 25 questions of 4 marks each. The tests were conducted using Google Forms to assess the impact of the online teaching and training on the attendees, and marks above 80% were graded as a pass. There was no negative marking.

Statistical analysis was performed using the Statistical Package for the Social Sciences software (SPSS Inc., Chicago, IL, USA) for Windows (15.0 version). The categorical variables (numbers of candidates) were presented as numbers (percentages) and were analysed using the Chi-square test for the pre-test and post-test groups. The continuous variables were presented by mean ± standard deviation (mean score) value when required. For comparison of the means between pre and post-test groups, Student's *t*-test was used with a 95% confidence interval. $P < 0.05$ or 0.001 was regarded as significant.

RESULTS

A total of 176 MOs were trained. None of the MOs scored more than 80% during the pre-test. The Chi-square analysis revealed that the majority (60.23%) of candidates had scored <50% and 39.77% had scores of 50%–80%; 0 candidates scored >80% in the pre-test. In the post-test analysis, the majority of the candidates (86.93%) had scored >80%, and 13.07% candidates scored between 50% and 80%;

Table 1: District-wise distribution of MOs and CHOs

District Name	MOs (number)	CHOs (number)	District Name	MOs (number)	CHOs (number)
Allahabad	4	15	Mahoba	2	14
Amethi	2	7	Meerut	6	16
Aligarh	2	14	Muzaffarnagar	2	15
Azamgarh	2	5	Mathura	2	13
Agra	10	15	Maharajganj	2	6
Auraiya	2	3	Moradabad	2	13
Balrampur	5	16	Mahamaya Nagar	2	15
Bagpat	2	14	Mirzapur	4	6
Bareilly	2	12	Pratapgarh	2	5
Bulandshahr	2	18	Pilibhit	2	8
Basti	2	6	Rampur	2	15
Bahraich	2	10	Sant Ravidas Nagar	7	5
Badaun	2	19	Shahjahanpur	1	14
Chitrakoot	2	2	Saharanpur	2	12
Chandauli	2	7	Sultanpur	2	6
Deoria	6	11	Shamli	2	13
Etawah	4	8	Sonbhadra	4	1
Firozabad	5	13	Shravasti	2	12
Farrukhabad	3	12	Siddharth Nagar	3	4
Faizabad	3	11	Sitapur	5	11
Fatehpur	2	7	Unnao	2	10
Ghaziabad	5	10	Jalaun	2	11
Gautam buddha Nagar	6	13	Kanpur	10	8
Gorakhpur	6	7	Kaushambi	4	7
Gonda	2	6	Kanshiram Nagar	2	8
Hapur District	2	7	Kannauj	3	11
Hardoi	2	8	Lucknow	6	7
Hamirpur		10	Lalitpur	2	6
Bijnor		15	Lakhimpur Khere		8
Etah		5	Mainpuri		6
Ambedkar Nagar		2	Varanasi		12
Barabanki		13	Raebareli		10
Ballia		16	Sant Kabir Nagar		7
Banda		2	Sambhal		12
Ghazipur		5	Kheri		8
Jaunpur		6	Mau		13
Jyotibaphulenagar		13			
Jhansi		9			

MOs - Medical officers, CHOs - Community health officers

0% candidates had scores of <50%. Statistically significant differences were found ($P < 0.0001$) while comparing the difference in the number of candidates in the pre- and post-test groups [Table 2, Figure 1]. The mean post-test score was 89.05 ± 12.74, which was higher than the mean pre-test score of 47.82 ± 9.45; this difference was statistically significant ($P < 0.0001$).

A total of 720 CHOs received training. All of them took the pre-test, but 222 candidates were unable to take the post-test due to various reasons. Statistical analysis after application of the Chi-square test revealed that the majority (82.92%) of candidates had scored <80%, and 17.08% of candidates scored >80% in the pre-test. In the post-test analysis, the majority (75.90%) had scored >80% and 17.08% candidates scored <80% [Table 3, Figure 2]. A statistically significant difference was found ($P < 0.0001$) while comparing the difference in the numbers of candidates in the pre- and post-test. The mean post-test score was 90.5 ± 7.42, which was higher than the mean pre-test score of 62.76 ± 11.34; this difference was statistically significant ($P < 0.0001$).

MOs performed better in post-test when compared to CHOs. Furthermore, none of the MOs skipped the post-test while 222 CHOs did not give the post-test.

DISCUSSION

The COVID-19 pandemic and the daily emergence

Table 2: Comparison of pre-test and post-test scores* of the MOs

	No. of MO trainees in Pre-test [T=176]	No. of MO trainees in Post-test [T=176]	Test applied
No. of trainees who scored >80%	0 (0%)	153 (86.93%)	Chi-square=282.8, *P*<0.0001
No. of trainees who scored 50%-80%	70 (39.77%)	23 (13.07%)	
No. of trainees who scored <50%	106 (60.23%)	0 (0%)	
Mean score±SD [out of 100]	47.82±9.45	89.05±12.74	*t*=34.48, *P*<0.0001

MO - Medical officer; No: number; SD: Standard deviation. *None of the candidates skipped the post-test. *Score is out of 100. Each question carries 4 marks. No negative marking for wrong answers

Table 3: Comparison of pre-test and post-test scores* of the community health officers

	No. of CHO trainees in Pre-test [Total number-720]	No. of CHO trainees in post-test [Total number-498]	Test applied
No. of trainees who scored <80%	597	120	Chi-square=420.6, *P*<0.0001
No. of trainees who scored >80%	123	378	
Mean score±SD [out of 100]	62.76±11.34	90.5±7.42	*t*=47.95, *P*<0.0001

CHO - Community health officer. Total of 222 candidates skipped the post-test. *Score is out of 100. Each question carries 4 marks. No negative marking for wrong answers. *P*≤0.05 considered as significant

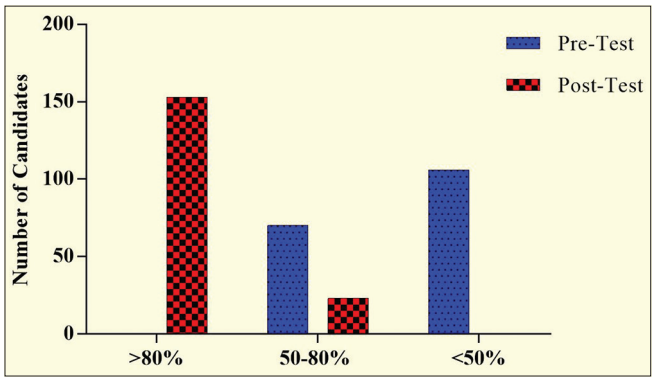

Figure 1: Pre-test and post-test scores of the medical officers. X-axis represents marks scored by trainee candidates in percentage. Y-axis represents total number of candidates scoring >80% marks, 50-80% marks and <50% marks in pre-test and post- test. None scored >80% marks in pre-test and none scored <50% marks in post-test

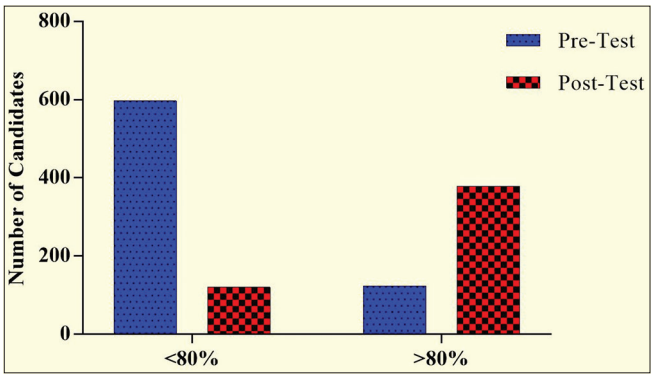

Figure 2: Pre-test and post-test scores of the community health officers. X-axis represents marks scored by trainee candidates in percentage; Y-axis represents total number of candidates scoring >80% marks and <80% marks in pre-test and post- test

of new coronavirus variants makes it challenging to resume usual teaching patterns; therefore, interactive web-based educational programmes are viable, futuristic strategies for training and teaching in all fields. In our country, MOs and CHOs comprise a major part of the healthcare system.

The MOs and CHOs participated enthusiastically in the training programme and their performance improved significantly after the training; they were prepared to set up ICUs or HDUs if the opportunity arose. The average score of MOs improved to 89.05 ± 12.74 in the post-test in comparison to 47.82 ± 9.45 in the pre-test. All of them gave the post-test and 153 out of 176 were declared passed in the post-test. The pre-test score of CHOs was 62.76 ± 11.34, which improved to 90.5 ± 7.42 in the post-test. Total 378 candidates were declared passed while 222 skipped the post-test.

A literature review on known barriers and solutions while developing and implementing online learning programmes for medical students and postgraduate trainees reported that online teaching is useful for overcoming these barriers.[6] Furthermore, a study on the challenges of online medical education also reported a positive impact of the COVID-19 pandemic on online medical education. They found that it provided a good opportunity to engage medical students and faculty in transforming the current pandemic-imposed remote medical education into evidence-based paradigms.[7]

A national survey evaluating the effects of the COVID-19 pandemic on the training of anaesthesiology postgraduate students in India showed that the pandemic provided opportunities for developing leadership qualities, improving preparedness for disaster management and facing future calamities. The survey also highlighted the role of anaesthesiologists as trainers of other treating physicians during this

pandemic[7,8] Another study also reported that the use of telemedicine technologies during undergraduate medical training improves competencies, knowledge, and learning and results in higher quality patient care.[9]

A study was conducted on the impact of a modular training programme on ICU performance in three resource-limited general adult ICUs in India, Bangladesh, and Nepal. The training programme had six modules on basic intensive care practices for 2–3 weeks over 20 months. They found that a structured training programme was associated with a decrease in ICU mortality and reduced hospital stay.[10]

Many advisories and education modules have been designed by medical professionals worldwide to help the healthcare workers in the treatment of COVID-19 patients.[11-17]

In our training programme, the MOs were provided detailed training on oxygenation and ventilation for COVID-19 patients. They were interested in learning about high-flow nasal oxygen and non-invasive ventilation, which were demonstrated physically and in the video form. Based on the results of the post-test, their knowledge of oxygenation and ventilation had improved. The MOs were also trained regarding methods for reducing oxygen wastage and actively participated in blood sugar management for COVID-19 patients.

The CHOs were taught monitoring of COVID-19 patients and took an active interest in discussions about infection control practices in the ICU and biomedical waste management. The CHOs were initially confused about the biomedical waste management of COVID-19 patients and the steps for donning and doffing; however, in the post-test, they answered questions regarding infection control accurately.

However, one limitation of the online training was that few candidates were unable to keep up with the pace of the training module and it was difficult to keep track of all the trainees. Trainees who were less willing skipped the post-test and could not be assessed. Some other reasons were abrupt and emergency duty postings and transfer to other areas due to lack of staff during the pandemic, fear of being put on COVID-19 ICU duty after clearing the test, and network issues for those MOs and CHOs who were attending training from remote locations. This may have affected the results of the post-test. However, it was clear from the training programme that knowledge of both MOs and CHOs improved after ICU training online, and we were able to clear many myths related to COVID-19 among healthcare professionals. They were also encouraged to get vaccinated as soon as possible. Before training, the MOs and CHOs were largely unaware regarding the management of critically ill patients in ICU, specifically COVID-19 positive patients. Candidates were educated regarding the stage in which patients should be treated in PHCs and CHCs and the stage in which transfer to higher centres was required. Many of these trained MOs and CHOs were later posted in critical areas after training and contributed to patient management.

CONCLUSIONS

Online training is useful as it can be provided to candidates at various locations within a short period of time. Further research on effectively delivering medical education online may help unlock its full potential.

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Conflicts of interest

There are no conflicts of interest.

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