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Development and validation of structured training module for healthcare workers involved in managing pediatric patients during COVID-19 pandemic using "Objective Structured Clinical Examination" (OSCE)

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Abstract:

BACKGROUND: COVID-19 (Coronavirus disease-19) is an ongoing pandemic. COVID vaccine administration in adults has provided some degree of protection from infection but children are still susceptible So, we have to be prepared to handle COVID-19 infection in children by training our healthcare workers by updating both their knowledge and skills. We developed a training module to train our healthcare workers in all domains of learning and also planned related assessment methods to know the effectiveness of the module.

MATERIALS AND METHODS: This was a quasi-experimental study with pre- and post-intervention conducted at a tertiary-level teaching medical college in southern India from July to September 2021. The training module was developed as per the "ADDIE" model of the development process module. It was further validated by five experts before implementation. In addition to the quasi-experimental method of evaluation like pre- and post-test, Observed Skill clinical examination (OSCE) had been also used as an assessment tool at the completion of training. A total of 92 participants have been trained as per this module in our tertiary-level care hospital. The association between continuous and categorical variables was assessed using an independent t-test and ANOVA, and paired t-test was used for comparing the difference between pre- and post-test scores.

RESULTS: Pre-test scores had no association with years of experience ($P = 0.803$) and previous training status of participants ($P = 0.350$). The mean difference of pre- and post-test scores was 3.8 and it was statistically significant (P value < 0.001) A weak positive correlation between pre- and post-test was present by the Spearmen correlation test (r = 0.337). The correlation between post-test score and OSCE score does not have a significant correlation.

CONCLUSION: Structured training module was effective in training the participants. Multimode assessment method (Pre-test, Post-test, and OSCE) is an important step to evaluate any training program as compared to only the pre- and post-test methods of evaluation.

Keywords:

Children, COVID-19, health personnel, OSCE, pandemic

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Introduction

As the COVID-19 pandemic spread rapidly to all parts of the world, there was an urgent need to train healthcare workers to deal with COVID-19 cases. Although the number of pediatric patients was less compared to adults in the first wave of the pandemic, the proportion of children affected increased in the second wave.[1] Many experts predicted that children will be more susceptible during subsequent waves of the COVID-19 pandemic. Hence, training all healthcare workers in managing pediatric COVID-19 cases became a necessity to deal with subsequent waves effectively.[2]

Updating the knowledge and skills of healthcare workers by training is essential when dealing with new challenges like the COVID-19 pandemic. Many studies have shown that structured training modules are far more effective in enhancing the knowledge and skill of learners than simple teaching sessions. There are many instructional design models available for developing course modules but the most widely used is the ADDIE model as it is the most practical. It has five stages, viz, Analysis, Design, Development, Implement, and Evaluation.[3,4] It offers a task-oriented framework that maintains the focus of the module designer on the goal of the trainees.[5] Various assessment methods are used to assess the effectiveness of the training program. A traditional pre-test and post-test conducted at starting and end of the program, respectively, is the commonly used method. However, the pre- and post-tests only checks the level of knowledge gained not the skills. As acquiring theoretical knowledge alone is not enough in clinical scenarios where the trainee should be able to demonstrate psychomotor skills. To overcome this, the Observed Skill clinical examination (OSCE) would be a better mode of assessment than only the pre-test and post-test in the training program. OSCE is an objective method to assess the trainee as per the level of competencies to be achieved in the training. It involves multiple time-bound stations, each station has some tasks to perform, which are assessed by the assessors as per the standardized uniform checklist provided.[6] However, to conduct OSCE, trainers need to put more effort into preparation and the orientation of assessors and trainees, and it also needs more resources, space, and time. Applying one's knowledge and performing learned clinical skills in a simulated environment in OSCE leads to increased confidence of participants and can further help by having feedback from the assessors.[7,8] This type of assessment becomes more significant if we are dealing with training where the risk to patient or clinicians are involved if real clinical scenarios are to be considered. So, this study was done to develop a structured training module and to assess its effectiveness in enhancing competencies of learners in managing COVID-19 infection in children. The instructional method and assessment are novel due to blended training method along with a structured training module based on the ADDIE model followed by multimode assessment (pre-, post-test, and OSCE) to assess healthcare workers for emergency preparedness related to the management of COVID-19 pandemic.

Material and Methods

Study design and setting

This was a quasi-experimental study with pre- and post-intervention and OSCE conducted at tertiary-level teaching medical college in South India from July to September 2021.

Study participants and sampling

Study participants: All nursing officers who were involved in COVID care in our hospital.

Sample Size Calculation: A conventional method of recruiting participants had been adopted to include all nursing officers involved in COVID care in our hospital. As all the nursing officers were included in the study, sampling was not done. Post-study power analysis showed that the effect size and standard deviation have power more than 90%, hence sample size is justifiable.

Data collection tool and technique

Study tool: The questionnaire was evaluated by four experts for content validity. The content validity of the questionnaire was done by estimating the content validity index and the content validity ratio.

A training module was developed as per guidelines of Health and Family Welfare for COVID-19 management in children. The training module was developed as guided by the "ADDIE" model of module development.[3-5] The components of the structured training module developed are tabulated in Tables 1 and 2.

A pre-test had been done by all the participants 3 days before the day of the program. After the pre-test, study material was released to all participants at least 2 days before the program. A structured training program was conducted by the department of pediatrics, as per the module developed for training for the management of COVID-19 infection in children. The training program included knowledge about COVID-19 infection in children, its presentation, severity assessment, and skill stations. Skill stations included all the skills required to manage pediatric COVID-19 cases, like vital monitoring, use of oxygen delivery devices, airway management, chest compressions, fluid and inotropes calculation, and counseling of patient attendants. All stations were conducted in small batches of four to five participants per

Table 1: Domain-wise components of OSCE of a structured training module for healthcare workers

Stations	Domain (K/P/A/C)	Equipment	Competency level (K/KH/S/SH)	Time duration
Airway Management	Psychomotor	Mannequin, Shoulder roll Suction, Hand Sanitizer, Gloves	SH	3 min
Bag & Mask Ventilation	Psychomotor	Mannequin, AMBU Mask AMBU, Hand SanitizerGloves	SH	3 min
Chest compression	Psychomotor	Mannequin, Hand Sanitizer Gloves	SH	3 min
Vitals checking	Psychomotor	Pulse oximeter, BP apparatus, Watch, One dummy patient Hand Sanitizer, Gloves	SH	3 min
Oxygen delivery devices	Psychomotor	Nasal Prongs, Face mask, Oxygen Hood, Non-Rebreathing Mask	KH	3 min
Counselling of parents/relative of Covid-19 infected children	Affective/ Communication	One dummy patient's relative, Sheets for documentation, Pens	SH	3 min
Fluid calculation as per weight of child	Knowledge	Calculator, Sheets for documentation, Pens	KH	3 min
Starting and adjusting Inotropes Infusion	Knowledge	Calculator, Sheets for documentation, Pens	KH	3 min

Table 2: Details of Structured Training Module and assessment methods

Specific learning objectives	Learning Domain (K/P/A/C)	Level of competency (K/KH/S/SH)	Teaching and learning methods	Assessment tool	Marks percentage
Identify symptoms & signs of COVID-19 infection	K	KH	Webinar, Module materials	MCQs through post-test	20
Assess severity of disease	K	KH	Webinar, Module materials	MCQs through post-test	
Do initial management in all cases	P	SH	Small group discussion (Skill Stations)	OSCE	10
Monitor the progress in condition of patient	P	SH	Small group discussion (Skill Stations)	OSCE	20
Use oxygen delivery devices	P	SH	Small group discussion (Skill Stations)	OSCE	10
Perform or assist in life-saving maneuvers	P	SH	Small group discussion (Skill Stations)	OSCE	30
Counsel the patient's family non-judgmentally	A/C	SH	Small group discussion (Skill Stations)	OSCE	10

station. After completion of training sessions, post-test and OSCE were conducted. OSCE was conducted by trainers with the help of a pre-designed scoring checklist to objectively assess the skills gained by participants. Post-test result and OSCE marks were calculated for all participants. A debriefing session and reinforcement of the important points had been done in the end. Feedback was collected from all participants. Data were entered into excel sheets and analyzed statistically.

Statistical analysis

The categorical variables were summarized as frequency and percentage. The continuous variables were summarized as mean and standard deviation. The association between continuous and categorical variables was assessed using an independent t-test and ANOVA. The difference between pre- and post-test scores was assessed using paired t-test. The correlation between variables was assessed using the spearman correlation coefficient. The P value < 0.05 was considered as statistically significant. Data were collected with Microsoft Excel and analysis was done using Epi Info Version 7.2.4.

Ethical consideration

The institute ethical committee approval was taken (AIIMS/MG//IEC/2022/149). Written informed consent was obtained from all participating staff for using the data for study purposes. The ethical concerns like confidentiality and the rights of respondents to drop out any time they wish were ensured. For the sake of confidentiality, we did not record any identifying information of the respondents.

Results

A total of 92 study participants were included in the study. The majority of study participants were women 72.8% (n = 67) whereas men were 27.2% (n = 25). Around 9.8% (n = 9) of study participants were having experience of less than 1 year, 66.3% (n = 61) of study participants were having 1 to 5 years experience, and 23.9% (n = 22)

were having more than 5 years experience. Around 77.2% (n = 71) were not trained in COVID-19 pediatrics care and around 15.2% (n = 14) had prior physical hands-on training and 7.6% (n = 7) had attended only virtual training. The overall mean (SD) pretest score of study participants was 10.3 (2.8). The mean (SD) pretest score in the general pediatrics care domain was 2.8 (1.2), the pediatrics resuscitation care domain was 3.8 (1.4), and in the pediatrics COVID Care was 2.9 (1.2). The mean pretest score does not have any significant association with years of experience and training status.

The Table 3 shows that the mean (SD) post-test score of study participants was 14.1 (1.9) and the mean difference in score was 3.8 which is statistically significant (*P* value = <0.001). The Table 4 shows the comparison of post-test and OSCE scores with demographic and basic details. The post-test score does not have any significant association with gender, years of experience, and training status. The overall mean (SD) OSCE score was 58.4 (9.9). The OSCE score was higher among females compared to males which is statistically significant (*P* value = 0.013). The years of experience and training status do not have a significant association with OSCE score. Around 12% of study participants were not attained adequate knowledge and skills. Figure 1 shows the correlation between pre- and post-test scores. The spearmen correlation test showed a statistically significant weak positive correlation between pre- and post-test scores (r = 0.337). The correlation between post-test score and OSCE score is shown in Figure 2. The post-test score and OSCE score do not have a significant correlation.

Discussion

We found that around 77.2% of healthcare staff was not having any training for managing pediatric COVID-19 infection before this training at our institute. This percentage is worrisome if we are aiming to manage COVID-19 pediatric patients effectively. Having a structured program for emergency preparedness or pandemic management is a dire need of the hour to give professional care to patients and minimize the negative impact of the disease.[9] In managing any one patient in a hospital, usually the doctor: nurse ratio should be ≤ 1:5, so it reflects the need to train nursing staff as a first step. Various modalities of training have been adopted during COVID-19 pandemic preparedness such as online, offline, lectures, small group discussions, demonstrations, and simulation. All modalities have their pros and cons as far as COVID preventive measures are concerned. Many research articles demonstrated the simulation as a modality of training in COVID preparedness but, for conducting simulation training, we need a lot of resources. We have conducted the training involving didactics followed by training in small groups with skills demonstrations

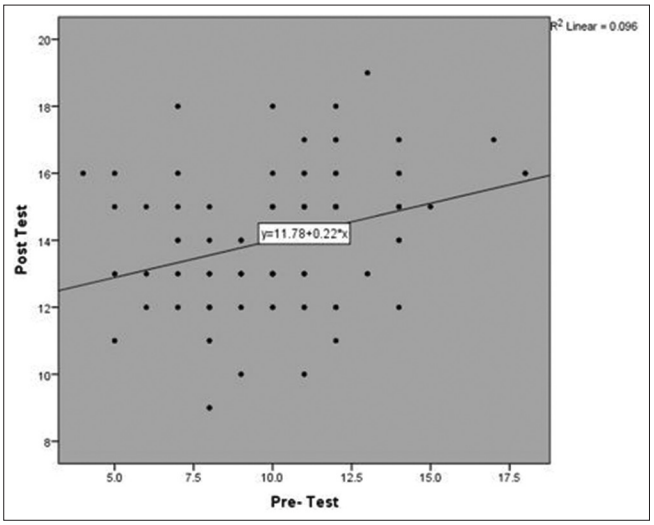

Figure 1: Correlation of pre- and post-test scores of the study participants

Table 3: Comparison of Pre- and Post-test scores of study participants

Test	Mean Score	Standard Deviation	Mean Difference (SD)	95% CI of Mean Difference	*P*
Pre-test	10.3	2.8	3.8 (2.8)	3.2-4.4	<0.001
Post-test	14.1	1.9			

Table 4: Comparison of Post-test and OSCE Scores with Demographic and Basic Details

Item	Subgroup	Post-test Maximum Score 20		OSCE Maximum Score 80	
		Mean (SD) Score	*P*	Mean (SD) Score	*P*
Gender	Male	13.3 (1.9)	0.171	54.3 (8.9)	0.013
	Female	14.1 (2.4)		59.9 (10.1)	
Years of Experience	<1 year	13.3 (2.5)	0.418	57.0 (6.7)	0.525
	1-5 years	13.7 (2.3)		57.8 (10.8)	
	>5 years	14.4 (2.1)		60.4 (8.6)	
Training Status	Trained Virtually	14.4 (1.8)	0.057	52.1 (8.7)	0.096
	Trained Physical	14.5 (2.5)		55.6 (9.7)	
	Not trained	13.7 (2.2)		59.5 (9.9)	
Total Mean Score (SD)		14.1 (1.9)		58.4 (9.9)	

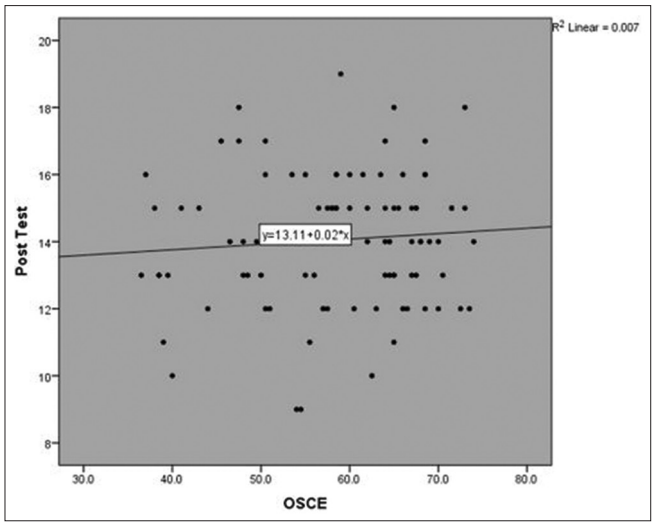

Figure 2: Correlation of post-test score and OSCE of the study participants

stations covering all the measures required to manage these patients. Domains covered in our training program were general pediatric care, pediatric resuscitation care, and pediatric COVID care. To cover these domains, we have organized six skill stations such as vital monitoring, airway management, soft skills like bag-mask ventilation and chest compression, oxygen delivery devices, fluids and inotropes management, and counseling for patients condition. We have conducted pre-, post-test, and OSCE as an assessment method to know the efficacy of our structured educational training for the COVID-19 preparation in children. It has been postulated from previous literature that to know whether any training program is effective or not, we should use a combination of assessment tools, also called as "multimodal method."[10] Pre-test and post-test were conducted by administrating multiple choice questions related to domains covered in our training modules before and after training sessions. OSCE is a structured supervised assessment tool in the form of a series of timed stations with examiners grading the performance of the trainee through a standardized checklist.[6] It has the advantage of validity and reliability whereas it needs lots of planning, time, and space to conduct the stations.[6,10] Many studies have been done in the past to know the perception of participants for having OSCE as an assessment method. It has been found that it has the benefits of being a structured, objective, and reliable method of assessment. It has also been shown that it needs the meticulous preparation of both assessors and participants. Many studies also reported that it also results in more stress among participants and is considered tougher than other methods due to its objectivity.[11,12] However, there are various ways to overcome the challenges faced in conducting OSCE, like having trained faculties in OSCE, limiting the competencies as per the level of skills required as per professional levels of participants, and a good collaboration among all instructors and assessors, filling the gap of teaching and assessment outcomes.[13] We have also conducted training and orientation sessions for all the instructors and assessors involved in the conduct of the whole structured training program.

We compared the mean pre-test training score (10.3 ± 2.8) with mean post-test training score (14.1 ± 1.9) and found that the difference is statistically significant. Our study further added the Observed structured clinical examination (OSCE) as an objective to know the effectiveness of the training program. We found that there was no correlation between post-test scores and OSCE scores, which means we cannot just depend on our post-test score to prove any training program to be effective. The skill domain of learning has its unmatched value in managing sick patients aptly. We felt that to manage any health emergencies, we need to work on all domains of learning such as knowledge, skills, attitude, and communications. Attitude and communication are the relatively less discussed domains of learning in training programs. One study reported that almost 75% of clinicians have faced assault by patient's relatives at some point of care, it is an alarm bell to do some preventive measures.[14] Considering the unpredictable course of disease in COVID-19 infections due to lack of literature as it is a new pandemic, chances of losing trust in medical management is anticipated. So, we also included a skill station and one OSCE station for the ways to counsel the patients' relatives effectively. Hence, this training covered all domains of learning. We have assessed the efficacy of the training program by having combined scores of post-test and OSCE, so we have achieved the competency of "shows how" of miller's pyramid. During the pandemic, various modifications have been done to teaching and assessment methods of the medical curriculum in order to contain the COVID spread. Blythe *et al*.[15] published an article where OSCE has been modified as virtual OSCE (VOSCE) to conduct particle exams for final-year medical graduate students. Attenborough *et al*.[16] also used a hybrid OSCE mode for assessment of method for fourth-year medical students, in which case, they run a presentation of examination cases which is pre-recorded followed by questions or skills which students had to perform, and instructions and countdown all were included in the presentation itself. Then, they later did asynchronous grading of the student as per the recorded video. There is no published literature where OSCE has been used as an assessment tool during a training program. It also has an advantage in situations like COVID where you cannot conduct clinical examinations directly on patients, so a stimulated environment can help. In order to increase the standard of medical care, we can achieve the objectives of training by grading

the performance of trainees without risking the spread of disease.

Limitation and recommendation

One of the main limitations of our study is that it had no control group to compare the results of participants. For generalizing the results, we need to have a multi-centric study enrolling a greater number of participants and a control group.

The major strength of the study is that it can be done in limited resources setting while still achieving desirable results in all domains of learning. This study supports using OSCE as an additional tool for post-assessment in any training programs for increasing the learning and skills of participants.

Conclusion

The effectiveness of a training program can be increased by having a structured training module followed by structured multi-mode assessment tools at the end of training. OSCE is an important graded mode of assessment for conducting training effectively in a resource-limited setting in combination with the traditional way of pre- and post-test assessments in training programs.

Acknowledgments

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Contributions

RP and TA conceived the study. RP, TA, and VK collected data and performed statistical analysis. RP, and VK reviewed the literature and drafted the initial version of the manuscript which was critically reviewed by TA. All authors contributed to drafting of the manuscript and approved the final version of the manuscript. TA shall act as guarantor of the paper.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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