ORIGINAL ARTICLE

Retention of Knowledge and Efficacy of a Hands-on Training Session in Oxygen Therapy for COVID-19 among Healthcare Workers

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Abstract

Introduction: We conducted basic hands-on training in oxygen therapy and ventilatory management of coronavirus disease-2019 (COVID-19) patients to health care workers (HCWs) at our tertiary care hospital. We designed this study aiming to find out the impact of hands-on training in oxygen therapy for COVID-19 patients on the knowledge and degree of retention of this gained knowledge 6 weeks after the training session among HCWs.

Materials and methods: The study was conducted after obtaining approval from the Institutional Ethics Committee. A structured questionnaire consisting of 15 multiple-choice questions was given to the individual HCW. This was followed by a structured 1-hour training session on "Oxygen therapy in COVID-19", following which the same questionnaire was given to the HCWs with the questions in a different order. After 6 weeks, the same questionnaire with questions in a different format was sent to the participants as a Google form.

Results: A total of 256 responses were obtained for the pre-training test and post-training test. The median [IQR] pre-training test scores and post-training test scores were 8 [7–10] and 12 [10–13], respectively. The median retention score was 11 [9–12]. The retention scores were significantly higher than the pre-test scores.

Conclusion: About 89% of the HCWs had a significant gain of knowledge. About 76% of the HCWs were able to retain knowledge, which also means the training program was successful. A definitive improvement in baseline knowledge was observed after 6 weeks of training. We propose conducting reinforcement training after 6 weeks of primary training to further augment retention.

Keywords: Coronavirus disease-2019, Fight, Healthcare workers, Preparedness.

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Highlights

We designed this study aiming to find out the impact of hands-on training in oxygen therapy for COVID-19 patients on the knowledge and degree of retention of this gained knowledge 6 weeks after the training session among HCWs. About 89% of the HCWs had a significant gain of knowledge. About 76% of the HCWs were able to retain knowledge, which also means the training program was successful. The retention scores were significantly higher than the pre-test scores. A definitive improvement in baseline knowledge was observed after 6 weeks of training.

Introduction

Coronavirus disease-2019 pandemic has created havoc worldwide due to the highly infectious nature of the disease and little knowledge about its management.[1] In the second wave that our nation witnessed, there was an unprecedented surge of demand for resources in the context of management of COVID-19 patients resulting in an imbalance of the demand–supply ratio. Due to a huge surge in the number of cases at a given time, we witnessed an acute shortage of hospital beds and well-trained healthcare manpower to manage these cases. Therefore, the Department of Health and Family Welfare, Government of India, took this rightful initiative in providing hands-on training to HCWs of their hospitals in anticipation of the third wave of the pandemic. In the past as well, it has been evident that disease outbreaks represent a sudden need for teaching and training large numbers of HCWs for capacity building.[2,3] In the context of COVID-19 also, building surge capacity and optimizing therapeutic as well as operational resources have been re-emphasized for risk stratification as well as efficient clinical management.[4] Our hospital is one of the designated centers to train the HCWs. We are providing basic hands-on training in oxygen therapy and ventilatory management of COVID-19 patients.

However, since the number of hospitalized COVID-19 cases was very less as the second wave of the pandemic subsided, these HCWs would not have been putting this training to immediate use. It is well-known that deskilling/loss of retention occurs.[5]

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It may be possible that these HCWs do not fully retain and recall the knowledge gained during these sessions when we are hit by an actual third wave.

Therefore, we designed this study aiming to find out the impact of hands-on training in oxygen therapy for COVID-19 patients on the knowledge and degree of retention of this gained knowledge 6 weeks after the training session among HCWs. It is for the very first time that retention of knowledge has been assessed after conducting a hands-on training for basic oxygen therapy in critically ill COVID-19 patients.

Materials and Methods

This prospective interventional study was conducted after obtaining approval from the Institutional Ethics Committee. A written, informed consent was obtained from each participant.

A structured questionnaire in both English and Hindi language comprising 15 questions was designed and reviewed by two independent reviewers. The questionnaire was carefully constructed to assess the knowledge about oxygen therapy for COVID-19. The questionnaire was given to 10 participants each for English and Hindi languages, and feedback was obtained regarding the clarity of the questions. Necessary changes in the questions and further simplification of language were done as per the feedback to make the questions more easily understandable and nonambiguous. The responses from these participants were not included in the final analysis.

The final questionnaire consisted of two parts. Part 1 included voluntary consent for participation and demographic details like age, sex and educational qualification, nature of duties, phone number, and email ID. Part 2 consisted of 15 questions on devices used for oxygen therapy like nasal cannula, non-rebreathing mask, oxygen cylinder, high-flow nasal cannula, BiPAP ventilation, and monitoring of COVID-19 patients on oxygen therapy. Each correctly answered question carried "1" mark and "0" mark was given for wrong answers or non-attempt.

As many HCWs as possible within the month of August 2021 were approached. Intensivist doctors who had experience of working in critical care of COVID-19 patients were excluded. The HCWs who consented to participate were given a printout of a structured questionnaire consisting of 15 multiple-choice questions that aimed at assessing their baseline knowledge on oxygen therapy for COVID-19 (Set-I: pre-training test). Time allocated to complete the pre-training test was 10 minutes. This was followed by a standardized 1-hour hands-on training session in "Oxygen therapy for COVID-19". At the end of the training session, the same questionnaire was administered again to the HCWs, but the questions were in a different order (Set-II: post-training test). After 6 weeks of the hands-on training session, the same questionnaire with questions in a different order (Set-III: retention test) was sent to the participants as a Google form on WhatsApp.

Outcome Measures

Knowledge gained after the hands-on training session: An absolute score of at least 10 or more in the post-training test, if pre-training test score was <10, and improvement of score by 1, if the pre-training test score was >10.

Efficacy of hands-on training session: If >50% HCWs had a post-test score of >10.

Retention of knowledge after 6 weeks: If the HCW scored the same as in the post-training test or at least 9/15.

Flowchart 1: HCW enrollment flow diagram

Need for retraining: If the HCW was not able to score 7/15 marks in both the post-training test and retention test.

Success of hands-on training program: If >50% HCWs retained the knowledge.

Sample Size and Statistical Analysis

The total marks obtained from each HCW in the pre-training test, post-training test, and retention test were compiled in MS Excel sheet, and analysis was done using SPSS version 21.0 or higher. The results are presented as median and interquartile range for continuous nonparametric data and as percentages for categorical variables. Mann–Whitney *U* test/Kruskal–Wallis test as applicable was applied for median. Wilcoxon signed-rank test was used to compare paired medians within the group. A p-value < 0.05 was considered significant.

Results

A total of 295 participants were approached. All of them underwent hands-on training. Thirty-nine of these did not consent to participate in the study. So, a total of 256 responses were obtained for the pre-training test and post-training test. All these 256 participants were recontacted for the retention test after 6 weeks of training. Responses of retention test were obtained from 148 HCWs (Flowchart 1).

The demographic details of all participants ($N = 256$) have been shown in Table 1. Majority of these participants were females. Approximately half of the participants were in the age-group range 30–39 years. Nursing officers constituted a large chunk of the trainees.

The median [IQR] pre-training test score was 8 [7–10], post-training test score was 12 [10–13], and retention-test score was 11 [9–12], respectively (Table 2).

The knowledge gained after the hands-on training session and the efficacy of the training program were satisfactory as reflected in the post-test scores. There was retention of knowledge after 6 weeks of training that was seen in 76% of the HCWs who attempted the retention test, signifying that the hands-on training session was successful. Only 12% HCWs had scores <7/15, i.e., there was need to retraining in them (Table 3).

The post-training test scores were significantly higher than the pre-training test scores in the HCWs, irrespective of their

Table 1: Demographic details of the participant

	Frequency (N = 256)	*Percentage*
Gender		
Male	93	36.3
Female	163	63.7
Age-group		
20–29	37	14.5
30–39	125	48.8
40–49	61	23.0
50–59	32	12.5
60–69	1	0.4
Area		
COVID	173	67.6
Non-COVID	83	32.4
Designation		
Doctor	6	2.4
NSG officer	246	95.3
OT technician	4	1.6

Table 2: Median values of pre-training test, post-training test, and retention test

Variables	*Median [IQR]*
Pre-training test score	8.0 [7–10]
Post-training test score	12.0 [11–13]
Retention score	11.0 [9–12]

Table 3: Various parameters determining the efficacy, efficiency, as well as success of the training

Parameters	*Total number (%)*
Knowledge gained, i.e., post-test score >10 ($N = 256$)	228 (89%)
Effective, if >50% of HCW had post-training score >10 ($N = 256$)	Yes (89%)
Retention of knowledge, i.e., retention score atleast as much as post-training score or at least >9/15 ($N = 148$)	113 (76%)
Successful, if >50% of HCWs retained knowledge ($N = 148$)	Yes (76%)
Need for re-training, i.e., HCWs not able to score at least 7/15 ($N = 148$)	18 (12%)

area of work (COVID or non-COVID), gender, and age (except age 60–69 years, $p = 0.317$). Though the retention-test scores were significantly lower than the post-training test scores (except in the age group 60–69 years), these were significantly higher than the pre-training test scores (Table 4).

Discussion

Coronavirus disease-2019 pneumonia, caused by SARS-CoV-2, is a rapidly spreading pandemic that has transcended all borders. Our nation witnessed the second wave in April–June 2021. A rapid surge of critically ill patients saw the healthcare system being overwhelmed. An acute crisis of healthcare resources, including HCWs who were well-trained in assisting in critical care of COVID-19 patients, followed. This had a significant negative impact on COVID-19 patient management. As a result, it was realized that there was a dire need to train all the manpower working in the hospital for delivery of oxygen therapy.

In our study, we observed that the median [IQR] pre-training test score was 8 [7–10], post-training test score was 12 [10–13], and retention-test score was 11 [9–12], respectively.

The knowledge gained after the hands-on training session and the efficacy of the training program were satisfactory as reflected in the post-test scores. Retention of knowledge after 6 weeks of training was seen in 76% of the HCWs who attempted the retention test, signifying that the hands-on training session was successful. Only 12% HCWs had scores <7/15, i.e., there was need to retraining in them.

We observed a significant improvement in pre-test scores, when they were compared with median retention scores, which indicate that there was definitive improvement in baseline knowledge for oxygen therapy in COVID-19 patients and that these HCWs were better prepared for handling COVID-19 patients who require oxygen therapy. However, there was a significant fall when post-test scores were compared with retention scores. We postulate that conducting reinforcement training after 6 weeks might augment knowledge retention.

In a systematic review by Nayahangan et al. comprising a total of 15676 records and 46 studies, important educational experiences from past epidemics with a variety of educational content, design, and modes of delivery were described. They impressed upon the urgent need for evidence-based and standardized training programs that can be easily adapted locally for preparation for future viral pandemics.[6] Various studies from China during the local outbreak of COVID-19 concluded that low mortality and better patient outcomes were observed in provinces with ongoing training of critical-care physicians.[7,8] Therefore, we hypothesized that a structured hands-on training of HCWs would help in improving the knowledge and would ultimately result in a rapid escalation of the workforce capable of assisting in delivering basic oxygen therapy to COVID-19 patients.

Rapid training of HCWs has been conducted in the past, in the context of protected cardiopulmonary resuscitation, where the authors concluded that *in situ* stimulation resulted in rapid cohort training evidenced by improvement in time to key events in resuscitation and competencies with each session.[9]

In the specific context of COVID-19, a multicenter questionnaire-based study was conducted to know the awareness and baseline knowledge among the physicians about the medical management of COVID-19 patients.[10] However, a very recent observational study was conducted by Sharma et al., where they assessed knowledge after training HCWs on preventive measures for COVID-19 infection.[11] They conducted a pre-test and post-test after conducting a virtual training. They concluded that video-assisted teaching–learning through virtual platforms effectively trained health personnel on infection prevention and control practices during the COVID-19 pandemic. But, no significant change was observed in knowledge regarding the sequence of doffing. We believe this was due to the online teaching design adopted, which does not guarantee the attention span of the student. Ours was a hands-on training session, where the teacher–student ratio is more favorable and promotes one-to-one interaction and clarification of doubts on the spot.

Table 4: Inter-group comparison of between pre-training, post-training, as well as retention test

	Median [IQR]			*Wilcoxon Signed-rank test p-value*		
Variables	*Pre-test score*	*Post-test score*	*Retention test*	*Pre vs Post*	*Post vs Retention*	*Pre vs Retention*
Area						
COVID	8.0 [7–10]	12.0 [11–13]	11.0 [9–12]	<0.001	<0.001	<0.001
Non-COVID	7.0 [6–9]	11.0 [10–13]	10.0 [8–11]	<0.001	<0.001	<0.001
Age-group						
20–29	9.0 [7–10]	12.0 [10–13]	10.0 [8.5–11.5]	<0.001	0.011	0.074
30–39	8.0 [7–10]	12 [10–13]	11.0 [9–11]	<0.001	<0.001	<0.001
40–49	8.0 [7–9]	12.0 [10–13)	10.0 [9–12]	<0.001	<0.001	<0.001
50–59	7.0 [5.5–9]	11.0 [10.5–13.5]	11.0 [9–11]	<0.001	<0.001	<0.001
60–69	8.0 [8–8]	9.0 [9–9]	7.0 [7–7]	0.317	0.317	0.317
Gender						
Male	8.0 [7–10]	12.0 [11–13]	10.0 [9–11]	<0.001	<0.001	<0.001
Female	8.0 [7–9]	12.0 [10–13]	11.0 [9–11]	<0.001	<0.001	<0.001

Till date, also, direct teacher–student interactions have been considered the foremost way of imparting formal education. Therefore, we adopted a hands-on training program for teaching oxygen-therapy techniques to the HCWs.

It is for the very first time that a hands-on training has been conducted for the administration of oxygen therapy to critically ill COVID-19 patients, in preparedness for the third wave in our nation.

The results of our study have been very encouraging since we could train around 250 HCWs within a span of 1 week and around 76% of HCWs demonstrated significant retention of knowledge even after 6 weeks. We hope that the results of our study help in the formulation of more refined training strategies for training of HCWs in the future waves of the current pandemic and future epidemics as well.

There were several limitations of our study, which included a limited sample size and single-centered study. Since the second wave of the COVID-19 pandemic had subsided and cases were all-time low, we could organize a hands-on training. But as we see another surge of COVID-19 pandemic, conduction of online training via a virtual platform would be necessary. So, assessment of knowledge and retention after virtual platform teaching for basic oxygen therapy could have been helpful. Lastly, the retention scores could be analyzed for only those HCWs who took the online retention test. Therefore, the comparison between the retention scores and pre-test/post-test scores could be performed for the HCWs whose response we could record, i.e., 148 HCWs.

Conclusion

- The knowledge gained after the hands-on training session and the efficacy of the training program were satisfactory as reflected in the post-test scores. Retention of knowledge after 6 weeks of training was seen in 76% of the HCWs who attempted the retention test, signifying that the hands-on training session was successful.
- A definitive improvement in baseline knowledge for oxygen therapy in COVID-19 patients was observed after 6 weeks of training, which indicates that HCWs were better prepared for handling COVID-19 patients who require oxygen therapy.
- We propose conducting reinforcement training after 6 weeks of primary training, which would further augment the retention of knowledge retention in HCWs and help us in strengthening the HCW resources when the future waves of the ongoing pandemic strike.

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