

# Effect of COVID-19 Specific Critical Care Nursing Program on Knowledge and Skills of Nursing Officers in an Apex Level Hospital of Uttarakhand - A Pre-Post Design

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## Abstract

**Introduction:** COVID-19 was global pandemic during its outbreak and it brought challenges for healthcare workers at every level. The patients were admitted in ICU for critical care and COVID-19 specific nursing care was urge in need. Hence, to keep this background in mind there was specific need of training regarding COVID-19 critical care and the study was conducted on same.

**Methods:** A quantitative research analysis was done on 100 nursing personal who worked in COVID-19 areas. The knowledge was assessed and then training was given followed by reassessment of knowledge and skills. The training included different 12 critical care procedures which were specific to COVID-19 care.

**Results:** The study result showed the significant increase in knowledge from pre-test to post-test 1 and 2. The skill assessment was done for 12 procedures with the OSCE checklist. Nursing officers who performed better in posttest also performed better in OSCE skills assessment. COVID-19 specific critical care training program had a significant impact on knowledge and skills of nursing officers.

**Conclusion:** Evidence based nursing practice on COVID-19 specific critical care training was significantly effective on knowledge and skills of nursing officers. The simulator based training on different critical care procedure helped our nurses for enhancing their knowledge, practice, and skills during patient care.

**Keywords:** COVID-19, critical care nursing program, knowledge and skills

## INTRODUCTION

In December 2019, an outbreak of pneumonia was reported in Wuhan city, China. Initially, the zoonotic infection spread from human to human and soon became an epidemic. A novel coronavirus, later named “Severe Acute Respiratory Syndrome

Coronavirus 2” (SARS-CoV-2), was identified as the cause of this epidemic. An individual infected by this virus (COVID-19) can be asymptomatic or have symptoms ranging from mild to severe respiratory failure, requiring intensive care. Caring for this latter group of patients puts a significant burden on healthcare.<sup>[1,2]</sup>

According to a review by the WHO-China joint mission, out of 55,924 lab-confirmed cases in China, 6.1% were classified as critical (respiratory failure, shock, and multiorgan dysfunction) and 13.8% as severely critical (dyspnea, respiratory rate >30 breaths per min, oxygen saturation <93%, partial pressure of arterial oxygen to fraction of inspired oxygen (PaO<sub>2</sub>/FiO<sub>2</sub>) <300 mmHg, and increase in lung infiltrates >50% within 24 to 48 h).<sup>[3,4]</sup>

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The COVID-19 pandemic raises challenges for the healthcare workforce at every level. Critically ill patients with COVID-19 frequently require endotracheal intubation and mechanical ventilator support as part of the necessary management of acute respiratory distress syndrome associated with the disease. Many of these patients also require prolonged mechanical ventilation.<sup>[5,6]</sup> Thus, COVID-19 pandemic demands preparation and strengthening of ICU services in hospitals. Besides this, risk of person-to-person transmission increases with various aerosol generating procedures performed in ICU which also demands preparation of healthcare workers in infection prevention protocols and precautions specific to COVID-19 disease.

The health-care system is overburdened with a sudden surge in COVID-19 cases and also experiencing acute shortage of trained/skilled staff to care for large numbers of critically ill patients. Hence, protection of healthcare workers and preparedness of ICUs to confront an epidemic cluster should be the main priority, based on experiences learnt from MERS-coronavirus and 2003 SARS coronavirus.<sup>[7-9]</sup>

Hence, training the nurses in critical care skills including airway management, ventilator handling, hemodynamic monitoring, and other basic ICU skills (e.g., closed suctioning and nasogastric tube feeding) along with the precautionary measures to be taken while caring and performing critical care procedures on critical COVID-19 patients, is a pressing priority.

### Aim of the study

The aim of the study was to train the nursing officers for the management of critically ill COVID-19 patients.

### Objectives

The objectives are as follows:

- To assess the baseline knowledge regarding critical care of COVID-19 patients
- To deliver COVID-19 specific critical care nursing program
- To assess the post-knowledge regarding critical care of COVID-19 patients
- To assess the skills regarding critical care of COVID-19 patients
- To assess the effect of COVID-19-specific critical care nursing program on knowledge and Skills
- To find the association between demographic profile with knowledge and skills.

Keeping this in view, Dept. of Nursing Services in collaboration with ACCPD (Advanced Center for Continuous Professional Development) at AIIMS Rishikesh, planned a crash/short course (1 day) for capacity enhancement of nurses posted in COVID-19 unit. The content of the course was diligently fetched from multiple platforms, reviewed, and then approved by a multidisciplinary

team. The short course educated the nurses about basic foundational knowledge of COVID-19 specific critical care skills and new changes in basic skills to be implemented in COVID-19 cases.

## MATERIALS AND METHODS (METHODOLOGY)

### Research approach

Quantitative approach.

### Research design

Pre-experimental, one group pre-test-post-test design.

### Target population

Nursing officers of AIIMS, Rishikesh.

### Sample

Nursing officer posted in COVID-19 units.

### Sampling technique

Purposive sampling (Non-probability).

### Sample size

100 nurses.

### Variables

- Dependent variable: Knowledge and skills of nursing officers
- Independent variable: COVID-19 specific critical care nursing program.

### Research hypothesis

- H1 = Nurse's knowledge regarding critical care of COVID-19 patients would be improved after the implementation of the training program
- H2 = Nurse's practice regarding critical care of COVID-19 patients would be improved after the implementation of the training program.

### Operational definition

Improved Knowledge and Skills of Nurses about COVID-19 critical care nursing:

- Knowledge: Participants scoring 50% or higher have improved knowledge
- Skills: Participants scoring 70% on each procedure checklist, with must-do steps of procedures.

### Tools

- Part A – Demographic profile consisting of name, age, gender, qualification, years of experience, previous experience (critical/non-critical), and any other training in COVID-19 patient management
- Part B – Structured questionnaire consisting of 20 questions from all topics
- Part C–Skill Checklist of all skill (OSCE) stations with must perform steps and validated by experts.

## Structured short course

Twelve clinical experts were identified as a trainer for 12 different skill station modules. Then TOTs were done based on the updated guidelines of COVID-19 for each skill module. Structured skill station modules were developed as per the need of the hour. Checklists were prepared with highlighting the must-do/know points for each module. Structured skill station modules consisted of a handling syringe pump, male catheterization, insertion of a nasogastric tube, nasogastric tube feeding, arterial blood gas sampling skills, handling mechanical ventilator, female catheterization, defibrillator handling, airway suctioning, hemodynamic monitoring, use of assistive airway devices, and central line care. We chose these skill stations based on skills required during the care of critically ill COVID-19 patients at ICU setup.

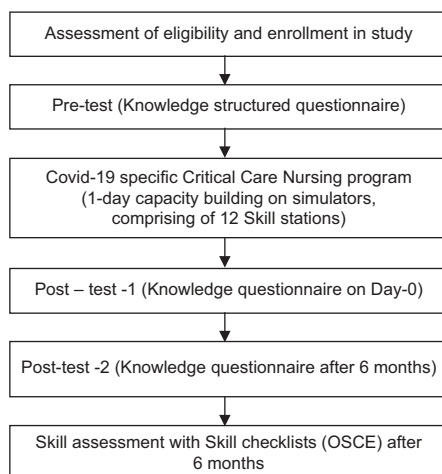
Nurses who were posted in COVID-19 units were identified and called for this structured skill station modules training. During the scheduled time, a group of 30 nurses, in subgroups of 5, rotated through 6 h of structured training, half an hour at each skill station with hands-on practices followed by 1 day posting at ICU under the supervision of ICU practitioners.

## Data collection method

Nursing officers of AIIMS, Rishikesh, posted in COVID-19 units were identified. A training program for capacity building in critical care of COVID-19 patients was planned, for this, consent was taken before assessment of the baseline knowledge using a self-administered structured questionnaire. One day COVID-19 specific critical care nursing program was conducted. Immediately after training, the post-test was conducted using the same structured questionnaire to assess the knowledge.

After a 6-months interval post-test was again conducted to assess the retention of knowledge and skill was assessed using a checklist on simulators.

## Data collection flow



## Potential benefit

Increase in knowledge and skills regarding COVID-19 specific critical care will help in the quality management of COVID-19 patients.

## Statistical analysis

This Quantitative data were analyzed using the frequency percentage method and inferential method for correlation of demographics. The data were analyzed by statistical software.

## RESULTS

The quantitative data analysis reveals that there was a statistically significant difference between the mean scores of the pre-test and post-test-1 and posttest-2. As per table 1 the mean knowledge score decreased from 15.10 (post-test-1) to 13.85 (post-test-2) at 6 months still it was significantly improved from baseline, that is, 8.55 (pre-test). Hence, there was significant retention of knowledge even after 6 months of training.

Skill assessment with OSCE checklists revealed in table 2 that out of 12 skills, nursing officers performed effectively at handling syringe pump (97%), male catheterization (95%), insertion of nasogastric tube (94%), nasogastric tube feeding (92%), arterial blood gas sampling skills (92%), handling mechanical ventilator (89%), female catheterization (88%), defibrillator handling (77%), airway suctioning (77%), hemodynamic monitoring (71%), use of assistive airway devices (65%), and central line care and handling (53%). Majority of the nursing officers performed skills effectively and demonstrated good practices related to aerosol generating procedures in ICUs.

Table 3 shows association between demographic variables and post-test-1, post-test-2, and OSCE scores of the participants.

Out of 100 nursing officers, 56 were male. In post-test-1, female scored well (93.18%) as compared with male (80.35%) whereas in post-test -2 male (91.07%) performed better than female (86.36%). In OSCE also, 46.42% male performed

**Table 1: Knowledge scores of the study participants (n=100)**

Participants' score	Mean $\pm$ SD	P-value
Knowledge score		
Pre-test	8.55 $\pm$ 3.91	0.000*
Post-test 1	15.10 $\pm$ 3.66	0.000*
Post-test 2	13.85 $\pm$ 2.60	0.000*

\*Paired Samples Test; P value significant at the 0.05 level

**Table 2: Details of skills assessment scores (n=100)**

Name of procedure	Passing score (70%)	Pass score frequency (%)	Fail score frequency (%)
Nasogastric tube insertion	7/10	94	6
Nasogastric tube feeding	7/10	92	8
Arterial blood gas sampling	8/11	92	8
Basics of mechanical ventilator	8/12	89	11
Urinary catheterization (male)	9/13	95	5
Urinary catheterization (female)	10/14	88	12
Defibrillator handling	8/12	77	23
Use of syringe pump	7/10	97	3
Central line care and handling	20/29	53	47
Assistive airway devices	24/34	65	35
Hemodynamic monitoring	32/45	71	29
Airway suctioning	10/14	77	23

**Table 3: Association of participants' knowledge and skill scores with demographic variables (n=100)**

Demographic	Frequency (%)	Post-test 1			Post-test 2			Skill station		
		Adequate	Inadequate	P-value	Adequate	Inadequate	P-value	Effective	Ineffective	P-value
Gender										
Male	56 (56)	45	11	0.059	51	05	0.333	26	30	0.282
Female	44 (44)	41	03		38	06		17	27	
Age										
<30 Years	82 (82)	71	11	0.482	72	10	0.371	36	46	0.453
>30 Years	18 (18)	15	03		17	01		11	07	
Educational qualification										
Diploma	32 (32)	24	08	0.034*	24	08	0.004*	13	19	0.457
Degree	68 (68)	62	06		65	03		30	38	
Total work experience in years										
5 Years	65 (65)	59	06	0.090	61	04	0.070	26	39	0.710
6 Years and above	35 (35)	27	08		28	07		17	18	
Previous training in critical care										
Yes	57 (57)	49	08	0.613	52	05	0.307	28	29	0.111
No	43 (43)	37	06		37	06		15	28	
Current experience										
COVID Unit	35 (35)	31	04	0.413	31	04	0.582	18	17	0.150
Non-COVID Unit	65 (65)	55	10		58	07		25	40	
Past experience in critical care unit										
Yes	34 (34)	30	04	0.447	30	04	0.552	17	40	0.211
No	66 (66)	56	10		59	07		26		
COVID Experience										
<6 Months	51 (51)	44	07	0.581	45	06	0.529	24	27	0.263
>6 Months	49 (49)	42	07		44	05		19	30	

\*Pearson Chi-square for P value

**Table 4: Correlation between knowledge and skills (n=100)**

Knowledge	Adequate frequency (%)	Inadequate frequency (%)	P-value
Pre-test	31	69	0.012*
Post-test 1	86	14	
Post-test 2	89	11	
Skill	Effective frequency (%)	Ineffective frequency (%)	
OSCE skill assessment	43	57	0.011*

\*PearsonCorrelation (Correlation is significant at the 0.05 level 2-tailed; Post-test 1 and 2 with Skill)

effective critical care skills as compared with 36.63% of effective females performers. Gender did not make any significant difference to the performance.

Majority of the nursing officers were <30 years of age (82%) only 18% nursing officers were above the age of 30 years. There was no significant difference in post-test -1 between two age groups whereas in post-test -2 and OSCE nursing officers of age more than 30 years performed better.

Nursing officers with more than 5 years' work experience performed better in skills whereas knowledge scores were better for nursing officers with up to 5 years work experience.

Educational qualification had a significant impact on knowledge of participants.

Participants with degree performed significantly better in post-test-1 ( $P = 0.034$ ) and posttest -2 ( $P = 0.004$ ) as compared with diploma holders. But qualification did not affect skills significantly.

Previous critical care training and critical care unit experience did not make a significant difference on knowledge but skills were performed better by those who had critical care unit experience and attended critical care training.

Nursing officers who were continuously posted in COVID-19 units and had more than 6 months of COVID-19 unit experience performed better in skills after 6 months of initial training than those were not posted in COVID-19 unit.

There was a significant association between post-test-1 (0.012) with skills and post-test-2 (0.011) with skills. Nursing officers who performed better in posttest also performed better in OSCE skills assessment. COVID-19 specific critical care training program had a significant impact on knowledge and skills of nursing officers.

## DISCUSSION

This study demonstrated a successful implementation of "COVID-19 specific critical care training program" for nurses.



Many studies found that one session of educational exposure was not inferior to multiple episodes of education.<sup>[10,11]</sup> As depicted in results participant's knowledge was improved in posttest-1 as well as there was significant retention of knowledge in posttest-2 after 6 months of initial training. This knowledge retention could be due to persistent exposure and practice of the participants in COVID-19 critical care units as all of them were posted in COVID-19 critical care units. Although participants posted in non COVID unit at the time of reevaluation did not perform skills satisfactorily. Participants posted in COVID units at the time of reevaluation performed skills effectively which can be due to continuous practice of these skills in COVID unit.

Covid-19 specific critical care skills were performed effectively on simulators.

As it has been stated that the use of high-fidelity simulators in nursing education increases the self-esteem and satisfaction, including effective learning and knowledge; it also brings students a critical perspective.<sup>[12-15]</sup> In the present study, effective performance was observed in handling syringe pumps, inserting urinary catheter in male and female, insertion and feeding through nasogastric tube, collection of arterial blood samples, handling ventilators and defibrillator, use of assistive airway devices with suctioning, care and handling central line with hemodynamic monitoring with special emphasis on precautions against aerosol generating procedures. All these skills are core competencies required for a critical care nurse and were demonstrated on simulators with redemonstrations and return demonstrations from participants. It has been stated that short-term interventions focused on technical skills augmented by a series of 30–60-min training sessions over a short period of time, with structured facilitation, evaluation, and debriefing, are associated with improved team functioning and performance.<sup>[16,17]</sup>

Nurses with experience and age more than 30 years demonstrated better skills. Though knowledge score was better for less experienced and <30 years' age group participants.

Participants with degree performed skills significantly better than diploma holders. Same relation was seen in another study and they found that hospitals with a higher percentage of RNs with higher degrees had lower rate of adverse patient outcomes such as rate of decubitus ulcers, failure to rescue, and post-operative deep vein thrombosis or pulmonary embolism and shorter length of stay. Hence, education makes a significant difference in skills.<sup>[18-20]</sup>

Although previous experience and training in critical care did not affect knowledge much, skills were effectively performed by those who had previous critical care unit experience or they had attended any critical care training.

Knowledge scores were significantly associated with skills performance. Participants with better knowledge performed better skills. Critical care training program enhanced knowledge and skills of the participants.

## CONCLUSION

Our short and structured crash course for management of critically ill COVID-19 patients improved knowledge and skills of the participants with ongoing monitoring and evaluation. This study validates the need of continuous education program and makes the nurses skillful and safe while providing high quality care to critically ill COVID-19 patients.

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## CONFLICT OF INTEREST

Nil.

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