Simulation training on donning personal protective equipment and performing cardiopulmonary resuscitation for nurses in a geriatric step-down hospital during COVID-19

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ABSTRACT

Background. Donning personal protective equipment (PPE) and performing cardiopulmonary resuscitation (CPR) are stressful tasks for healthcare professionals, particularly during the COVID-19 pandemic. This study aimed to assess the effectiveness of simulation training on donning PPE and performing CPR with PPE put on for nurses at a geriatric step-down hospital.

Methods. A lecture and simulation training on donning PPE and performing CPR were provided for nurses. Confidence in donning PPE and performing CPR, knowledge of CPR, and satisfaction of participants were assessed before training (baseline), after the lecture, and after the simulation training.

Results. 50 nurses (33 women and 17 men) attended both the lecture and simulation training, accounting for 90% of nurses in the department. Self-rated confidence in donning PPE and performing CPR improved significantly after the lecture (both p<0.001) and again after the simulation training (both p<0.001). Knowledge of CPR improved significantly after the lecture (p<0.001). Self-rated satisfaction of participants was high (9.3±0.3).

Conclusion. Simulation training on donning PPE and performing CPR with PPE put on significantly improves the knowledge and confidence of nurses in a geriatric step-down hospital. This may contribute to improved patient outcomes, particularly during the COVID-19 pandemic.

Key words: COVID-19; Hospitals; Simulation training

BACKGROUND

Coronavirus disease 2019 (COVID-19) has a high nosocomial infection rate and therefore healthcare workers are at risk of COVID-19 infection.¹ The use of personal protective equipment (PPE) is essential to protect healthcare workers from nosocomial infection, especially during aerosol-generating...
procedures such as cardiopulmonary resuscitation (CPR).\textsuperscript{2} Full PPE, including N95 respirator, face shield, isolation gown, and gloves, is necessary for aerosol-generating procedures.\textsuperscript{3} However, improper technique in donning and doffing PPE may lead to the spread of infectious agents among healthcare workers and patients.\textsuperscript{4} During the 2003 severe acute respiratory syndrome outbreak, it was documented that donning PPE took 3.5 minutes and may delay various interventions needed for patients.\textsuperscript{5} Healthcare workers who provide outreach services for long-term care facilities are also at risk of COVID-19 infection. Proper donning and doffing PPE technique is essential for care, especially for residents who need special care. Simulation training on donning and doffing PPE can reduce the time to intervention in hospital and long-term care facilities.\textsuperscript{6,7}

During urgent situations, healthcare workers may fail to recall critical steps in CPR.\textsuperscript{8} Simulation training can reduce stress during CPR and improve the non-technical skills of healthcare workers, as well as improving patient safety.\textsuperscript{9,10} This study aimed to assess the effectiveness of simulation training on donning PPE and performing CPR with PPE put on for nurses at a geriatric step-down hospital.

METHODS

This pretest-posttest study was approved by the Institutional Review Board of The University of Hong Kong / Hospital Authority Hong Kong West Cluster. The simulation training took place between January 2020 and March 2020 at the Tung Wah Group of Hospitals Fung Yiu King Hospital.

In January and February 2020, a demonstration video and lecture about donning PPE and performing CPR as well as interactive debriefing were provided by qualified American Heart Association Basic Life Support instructors. Fifteen nurses participated in each class, and each participant had to practice donning and doffing PPE under one-on-one supervision by infection control nurses.

In March 2020, simulation training on donning PPE to perform CPR using a CPR manikin (Resusci Anne Skill Reporter, Laerdal Medical, Orpington, UK) was provided by qualified simulation trainers, Basic Life Support instructors, and infection control nurses. Each class could accommodate a maximum of 10 nurses, who were divided into two groups. In a scenario of a patient having respiratory and cardiac arrest at nighttime, the nurses needed to carry out the following steps: call on-call medical officer, don PPE, and perform two-person CPR. When the on-call medical officer arrived, the nurses needed to doff the PPE.

Baseline demographics of participants were collected. Confidence in performing CPR and wearing full PPE was self-assessed using a scale ranging from 1 to 10 before training (baseline), after the lecture, and after the simulation training. Participants’ knowledge was assessed before training (baseline) and after the lecture, using six multiple-choice questions. Participant satisfaction was self-assessed using a scale ranging from 1 to 10 after simulation training.

Statistical analysis was performed using SPSS (Windows version 20; IBM Corp, Armonk [NY], US). Paired \( t \)-test was used to compare the change of continuous variables before and after training. A two-tailed \( p \) value of <0.05 was considered statistically significant.

RESULTS

Four lectures and seven simulation training sessions

| Self-confidence in donning personal protective equipment (PPE) and performing cardiopulmonary resuscitation (CPR), knowledge of CPR, and satisfaction of participants before and after training |
|-------------------------------------------------|--------|--------|-----------------|-----------------|-----------------|
| Confidence in donning PPE                       | 5.6±0.5| 7.3±0.4| 8.2±0.4         | <0.001          | <0.001          |
| Confidence in performing CPR                    | 4.5±0.6| 6.6±0.4| 7.8±0.5         | <0.001          | <0.001          |
| Knowledge of CPR                                | 4.4±0.4| 5.8±0.2| -               | <0.001          | -               |
| Satisfaction of participants                    | -      | -      | 9.3±0.3         | -               | -               |

Table 1. Self-confidence in donning personal protective equipment (PPE) and performing cardiopulmonary resuscitation (CPR), knowledge of CPR, and satisfaction of participants before and after training.
Simulation training on donning personal protective equipment and cardiopulmonary resuscitation for nurses

were conducted. 50 nurses (33 women and 17 men) attended both the lecture and simulation training, accounting for 90% of nurses in the department. 37 (74%) of the nurses had >3 years of clinical experience. Self-rated confidence in donning PPE and performing CPR improved significantly after the lecture (both p<0.001) compared with baseline and after simulation training (both p<0.001) compared with after the lecture (Table). Knowledge of CPR improved significantly after the lecture (p<0.001) compared with baseline. Self-rated satisfaction after the simulation training of participants was high (9.3±0.3).

DISCUSSION

Basic Life Support simulation training is associated with significant improvement in skills and performance in 30 registered nurses. Simulation training on resuscitation improves non-technical skills such as coping with stress. Proficiency and confidence in donning and doffing PPE improved significantly after simulation training. The confidence in PPE use improves from 64% to 85% after simulation training in 84 healthcare workers. Performing CPR with PPE put on is challenging, and the effectiveness of CPR may reduce. Simulation training on performing CPR with PPE put on enables healthcare professionals to foresee the difficulties and make early psychological preparation. With improved confidence in performing CPR, nurses may feel less stress and perform CPR more efficiently. This contributes to improved patient safety and outcomes.

In the present study, simulation training was more effective in improving the participant confidence in donning PPE and performing CPR than lecture. This finding is in line with the learning pyramid theory, which suggests that simulation training helps students to learn more and improve knowledge retention. Formal Basic Life Support classes in one training session are not adequate to prepare nurses to provide high-quality resuscitation efforts.

Most simulation training sessions are conducted in university or teaching hospitals, where specialised trainers and resources are available. Our findings suggest that simulation training can also be conducted in a geriatric step-down hospital. Owing to the closure of universities during COVID-19, simulation training in hospitals is recommended.

There were limitations to this study. Although confidence and knowledge in performing CPR were assessed, the actual standard of CPR was not evaluated. A more structural assessment of CPR is suggested. There was no control group; a randomised controlled trial is warranted to confirm the effectiveness of simulation training. Only the effect of one training course was assessed; the long-term effect on knowledge and skills should have been evaluated.

CONCLUSION

Simulation training on donning PPE and performing CPR significantly improves the knowledge and confidence of nurses in a geriatric step-down hospital. This may contribute to improved patient outcome, particularly during the COVID-19 pandemic.

CONTRIBUTORS

All authors designed the study, acquired the data, analysed the data, drafted the manuscript, and critically revised the manuscript for important intellectual content. All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

CONFLICTS OF INTEREST

All authors have disclosed no conflicts of interest.

FUNDING/SUPPORT

This study received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

DATA AVAILABILITY

All data generated or analysed during the present study are available from the corresponding author on reasonable request.

ETHICS APPROVAL

The study was approved by the Institutional Review Board.
Board of The University of Hong Kong / Hospital Authority Hong Kong West Cluster. The patients were treated in accordance with the tenets of the Declaration of Helsinki. The patients provided written informed consent for all treatments and procedures and for publication.

REFERENCES

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