

Original Research

Impact of Virtual Simulation to Teach EMS Personnel Respiratory Failure Management During the COVID-19 Pandemic

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Objective

This study presents a unique way to provide simulation education to paramedics during the Coronavirus pandemic, without some of the logistical concerns that accompany traditional in-person simulation.

Methods

Our county EMS personnel were divided in groups of 3-6 for the virtual simulation conducted by a physician facilitator who was remotely broadcasted to the EMS team performing tasks on a mannequin. A post-simulation survey was conducted to determine how the simulation affected their comfort level with managing respiratory failure in both suspected COVID-19 and non-COVID-19 patients.

Results

The 42 EMS personnel responding to the survey felt an increased comfort level in managing respiratory failure in a suspected or known COVID-19 patient after the virtual simulation. There was an increase in “extremely comfortable” responses from 24% to 43% before and after the simulation, and a decrease in “somewhat uncomfortable” responses from 10% to 0%.

Respondents had extensive prior EMS experience, with 95% stating 2+ years working in EMS, and 33% with more than 10 year’s experience. Only 12% of the responders stated they underwent simulation training once a month or more, with 64% stating “a few times per year”. 86% of the responders felt the video platform was easy to use. The most common technical difficulty involved audio problems.

Conclusions

EMS personnel undergoing a virtual simulation and debrief in the management of respiratory failure in the setting of the COVID-19 pandemic felt more comfortable in their management of these patients after their sessions. The majority recommended continuing this type of training in the future.

INTRODUCTION

Continuing education for emergency medicine services (EMS) personnel is often limited to online lectures and self-study, as educational resources vary from department to department. Moreover, social distancing measures during the current COVID-19 pandemic further limit the ability for in-person training experiences. Simulation, unlike traditional forms of online learning, allows educators to create specific learning objectives and reinforce clinical concepts through a scenario and debrief, in an environment that does not compromise patient safety.¹ Traditionally simulation is performed in-person, however given the need to socially distance, virtual simulation has been proposed in

various forms as an educational tool.²⁻⁶ The purpose of the current study was to assess whether simulation could be delivered virtually. Since lectures were already being delivered virtually, the platform for virtual education was already present, but the addition of a virtual simulation session was novel. We explored the perceptions of this innovative teaching modality in comparison to traditional educational models. This study presents a unique way to provide education to paramedics during the Coronavirus pandemic, without some of the logistical concerns that accompany traditional in-person simulation. To our knowledge, this was the first virtual simulation educational module done for paramedics.

METHODS

Our EMS system consists of 106 personnel, of whom 69 are medics. It serves a population of 74,000 in the Southeastern United States, covering 1507 square miles. The average call volume is 14,000 per year.

A virtual simulation on respiratory failure was designed by the research team, and delivered via the Zoom® platform. The participants were divided in groups of 3 to 6 with a designated team leader. They were allowed to work as a team since that is how the team functions in real life. Each session was virtually conducted by a physician. This scenario allowed emergency medical technicians to manage a simulated patient with respiratory failure during the COVID-19 pandemic through a virtual platform. The educational objectives for this scenario were to: 1) Identify risk factors of COVID-19; 2) Recognize the signs and symptoms of respiratory failure; 3) Discuss various methods for improving oxygenation and 4) Manage chronic obstructive pulmonary disease (COPD) and congestive heart failure (CHF) in the prehospital setting. The equipment needed for the scenario is summarized in Figure 1.

The physician facilitator was remotely broadcasted to the EMS team. The facilitator performed tasks on a mannequin as dictated by the EMS team. The mannequin's vitals were changed in real-time according to the actions of the team and were displayed via a virtual platform. Each session was approximately 25 minutes with 15 minutes designated for the scenario and 10 minutes for the debrief. EMS personnel then participated in a 13 question survey to determine how the simulation impacted their comfort level with respiratory failure in both COVID-19 patients and non-COVID-19 patients. They also provided feedback on the overall experience of the virtual simulation and any technical issues they faced during the session.

At the conclusion of the scenario, the facilitator led a 10 minute debrief addressing topics such as: modified treatment strategies during COVID-19, respiratory failure algorithm, differential diagnosis of a patient with respiratory distress, and diagnosis and assessment of a patient with CHF and COPD. This study received an exempt determination from our medical school's institutional review board.

RESULTS

In total 90 of our EMS personnel underwent a virtual simulation on respiratory failure. The cohort spanned various levels of experience. Thirty-three percent had been an EMS provider for more than 10 years; 26% for 6-10 years; 36% for 2-5 years; Only 5% had been there less than 2 years. Fifty seven percent were last enrolled in school more than 2 years ago. Sixty percent of the crew serve as paramedics; 21% as EMTs and 19% as firefighters. The highest level of education spanned high school (48%), associate's degree (33%), bachelor's degree (17%), and master's degree (2%). The majority (64%) participated in simulated education less than once a month.

Twenty four percent participated once a year. Thirty eight percent had never participated in any virtual simula-

tion. On the day of the simulation, 59% had technical difficulties. Nonetheless, 88% found the video conference platform easy to use. Figure 2 summarizes the comfort level of the medics in managing a respiratory emergency before and after the virtual simulation.

The 42 EMS personnel responding to the survey felt an increased comfort level in managing respiratory failure in a suspected or known COVID-19 patient after the virtual simulation (Figure 1). There was an increase in "extremely comfortable" responses from 24% to 43% before and after the simulation, and a decrease in "somewhat uncomfortable" responses from 10% to 0%. There was a slight increase in the comfortability of managing respiratory non-COVID-19 patients as well, with an increase in "extremely comfortable" responses from 40% to 48%, and a decrease of "somewhat uncomfortable" responses from 2% to 0%. Only 12% of the responders stated they underwent simulation training once a month or more. In general 86% of the responders felt the video platform was easy to use, and the most common technical difficulty involved audio issues.

DISCUSSION

Traditionally EMS training in many agencies including our own is live via in-person lectures or pre-recorded online lectures, which is mandatory on a monthly basis. Our learners are experienced adult learners therefore we referenced Knowles in his review of the adult education movement, which discussed the importance of education to be relevant, problem-based, and experiential for adult learners.⁷ To address these needs, we typically include a live hands-on simulation component in our training sessions, which occur quarterly. Simulation activities are difficult to perform across EMS agencies due to funding, rotating shift schedules, and distance between stations.

The COVID-19 pandemic has disrupted every facet of life, including medical education at all levels.⁸⁻¹⁰ As front line first responders, paramedics see patients earliest in the course of their emergency, often without knowledge of their underlying conditions.¹¹ One of the most frightening aspects of COVID-19 is the potential for acute respiratory decline. Normally, this is addressed with prompt airway control, but in COVID-19, non-invasive management¹² and high flow oxygen¹³ have been advocated, and the recommended management has varied with the evolution of the pandemic.¹⁴ There were also new recommendations around appropriately identifying COVID-19 patients, masking patients during transport, and limiting aerosolized procedures unless necessary. Communicating the modifications in the respiratory failure algorithm for COVID-19 patients was a challenge because our EMS system is large and diverse, and rarely in a single location at any given time.

An effective teaching modality that is well-received by learners is simulation,^{15,16} which enables control over the sequence of clinical events demonstrated to learners, provides opportunities to offer support and guidance to learners, and prevents unsafe and dangerous situations.^{17,18} Simulation also inherently lends itself to standardization,¹⁹ which is critical for delivering care during a pandemic. Sim-

ulation allows learners and educators to simultaneously work through a scenario in order to address and discuss any questions or concerns regarding the management of patients.

Thus, our study used virtual simulation to impart just-in-time knowledge of COVID-19 respiratory management to our EMS personnel. In order to better care for the citizens of our county during the pandemic, we needed to quickly update protocols for the management of these patients in a format which would be easily understood and recalled. This study allowed us to provide an interactive simulated educational activity in a socially distanced and safe manner across our large EMS system. Specifically, the medics did not have to drive to the simulation location and be out of service for any longer than the duration of the education, and the virtual setting meant that less simulation equipment and teaching personnel were necessary. This study shows that virtual simulation activities are effective and feasible for delivering timely education to pre-hospital providers.

LIMITATIONS

The current study has some important limitations. First, it does not allow for hands-on experience for the procedural components of the simulated scenario. It is possible to consider having a simulator in place at each station for learners to interact with, which could be viewed virtually by the facilitator. Second, the medics in this study had an online lecture about COVID-19 management a few weeks before the exercise, so this may have biased results. Finally, the post-test was given right after the virtual simulation exercise; measurements may reflect immediate recall only and not true learning.

CONCLUSIONS

EMS personnel undergoing a virtual simulation and debrief in the management of respiratory failure in the setting of the COVID-19 pandemic felt more comfortable in their management of these patients after their sessions. The majority recommended continuing this type of training in the future in survey responses. Our cohort had extensive EMS experience, but did not frequently undergo simulation training, which highlights a potential area of improvement for EMS education. COVID-19 was a virus that was an unknown entity which caused widespread fear in and around its ability to spread, morbidity and mortality. COVID-19 is a respiratory illness spread via droplets, therefore intubation, high-flow oxygen and CPAP are high risk procedures, therefore knowledge and comfortability with management is of utmost importance in the prehospital setting. First responders continue to be essential in the safe and effective management of COVID-19 patients, and virtual simulation is a viable option to facilitate EMS training.

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PRIOR PRESENTATION

This work was presented in abstract form at the American College of Emergency Physicians Research Forum, October 2021.²⁰

FUNDING

No funding was received for this study.

ABBREVIATIONS

CI- confidence interval

COVID-19- 2019 Novel Coronavirus

CPAP- continuous positive airway pressure

COPD- chronic obstructive pulmonary disease

CHF- congestive heart failure

EMS- emergency medical services

AVAILABILITY OF THE DATA AND MATERIALS

The datasets used and/or analyzed during the current study available from the corresponding author on reasonable request.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was submitted to our institutional ethics committee, the HCA Centralized Algorithms for Research Rules on IRB Exemptions (CARRIE)/IRB manager. The study was issued ID# 2020-408, and was considered exempt from IRB oversight per 45CFR46.102(l) and 45CFR46.104.

COMPETING INTERESTS

The authors declare they have no competing interests.

CONSENT FOR PUBLICATION

Not applicable as no identifying information/images are present in the study.

AUTHORS CONTRIBUTIONS

The survey was designed by AW, KM, CVD. AW, NE, and PP managed data capture. LG performed the statistical analysis, and supervised the conduct of the research. All authors contributed substantially to the drafting of the manuscript, and all authors approved the final version of the manuscript.

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