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Healthcare simulation to prepare for the COVID-19 pandemic

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Dear Editor,

Before the rapidly expanding COVID-19 pandemic [1] reached our institution, we leveraged a training simulation to (a) test algorithms/protocols, and (b) promote organizational integration to optimize management of patients suspected of COVID-19.

During previous outbreaks of contagious airborne disease, in situ simulation was successfully used to train staff, improve competency with personal protective equipment (PPE), and test protocols. Concurrent with our work, others leveraged simulation in the setting of COVID-19. [2–4] Our report is targeted at other simulation professionals, especially in anesthesia. We hypothesized that in the absence of clinical experience, immersive simulation of anticipated scenarios can improve protocols developed in round table discussions.

Restricted to internal participants by regulations, we converted a previously scheduled MOCA simulation course in our American Society of Anesthesiologists endorsed simulation program to train seven experienced anesthesiologists. The four scenarios related to COVID-19, designed by authors (MHA, EHS, DLR, VC and AD) included:

(1) cardiac arrest,
(2) emergency airway management,
(3) tele-instruction for remote guidance and supervision, and
(4) transporting an intubated patient.

Table 1 sketches the scenarios and summarizes the key lesions learned. Detailed scenarios, simulation procedures, detailed results, and our methods are co-published in Data-in-Brief. Using a grounded theory

Table 1
Case descriptions.

Case	Title	Central theme	Key lessons
1	Cardiac Arrest for Patient with Possible Communicable Airborne Disease	The central theme is the concept of "Protected Code Blue" where team member safety is emphasized. Procedures are altered to protect the resuscitation team in the context of airborne transmission.	Airborne disease may drive changes in the algorithm such as earlier advanced airway placement and stopping CPR for airway placement.
2	Emergency Airway Management for Patient with Contagious Respiratory Disease	The central theme is provider safety and containment of airborne transmission during airway management of a COVID-19 patient.	Dedicated airway kits can be optimized for COVID-19 patients and airborne disease may lead to different airway tools and management options.
3	Transport of a Patient with Contagious Airborne Disease	The central theme is on team coordination, communication with hospital entities and adherence to protocol to contain viral spread.	Interdisciplinary discussion to evaluate the need for transfer versus performing the procedure in patient room and coordination between "clean" and "contaminated" personnel is paramount.
4	Tele-instruction for Remote Procedural Guidance and Supervision	The central theme is communication and supervision via remote telecommunication to perform a life-saving procedure.	A focus on communication and shared mental modeling improve success in remote tele-guidance for procedures.

The table tabulates the four simulation scenarios representing anticipated clinical encounters with COVID-19 patients, which we simulated at Penn State Milton S. Hershey Medical Center in March 2020, prior to admitting any COVID-19 patient, with a view to training our providers and testing our COVID-19 protocols in realistic simulation scenarios. **Case** number and **Title** are in the first and second column on the left, respectively. The **Central Theme** of the scenario presented to the participant is sketched in the next column and **Key Lessons** elicited during our debriefings in the column can be found in the column on the right. More Detail is co-published in Data-in-Brief.

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approach, three authors (MHA, DRL, EHS) developed emergent themes and constructs from the debriefings as an informal qualitative thematic analysis. All participants and course instructors volunteered to participate in this educational program and contributed as co-authors to this letter.

During initial debriefing, we applied crisis resource management concepts including situation awareness, prioritization of tasks, and clear communication to COVID-19 scenarios. In subsequent debriefing, we re-evaluated formerly familiar processes, identifying and correcting shortcomings of new protocols, kits, and interdisciplinary cooperation. Examining plans for COVID-19 management in immersive simulated scenarios revealed shortcomings before such gaps threatened patient or clinician safety [2,4]. Crisis resource management simulation provided a safe approach to both prepare clinicians for changes in usual practice and integrate the organizational response across disciplines to confront an unprecedented pandemic.

The time needed to safely orchestrate an emergency intubation for a contagious patient surprised our airway experts. Team members noted that PPE introduced additional barriers to communication and clinical activities and emphasized the need for daily and pre-engagement huddles. Teams were divided into “clean” and “dirty” members who had to adapt to specific, overtly-designated roles. Our simulations were particularly effective for practicing donning and doffing of PPE, adjusting difficult airway management and resuscitation algorithms, and adapting to likely resource constraints, echoing reports from other airborne epidemics and authors [2,4]. Debriefings also revealed the high stress levels invoked by general uncertainty about the COVID-19 pandemic, particularly clinicians' concerns about their own health and the health of close relations, juxtaposed against distress about delaying help for patients while donning personal protective equipment. This exceptional crisis demands not only technical instructions and suitable protocols, but also emotional intelligence and resonant leadership. [5]

Testing our COVID-19 protocols in realistic simulated scenarios with a small expert team induced adaptations to make them more robust, simple, and fail proof [3,4]. Our simulations impacted organizational behavior, leading to changed scope of practice, altered resuscitation algorithms, and a raised awareness of an impending resource crisis [2]. We conclude that in the context of an emerging pandemic, simulation is a powerful tool to rapidly and safely test protocols to improve system-wide preparation for a pandemic [3,4].

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M.H. Andreae (MD)[a,*], A. Dudak (MD)[a], V. Cherian (MD)[a], P. Dhar (MD)[a], P.G. Dalal (MD)[a], W. Po (MD)[a], M. Pilipovic (MD)[a], B. Shah (MD)[a], W. Hazard (MD)[a], Rodgers DL (EdD)[b], Sinz EH (MD, MEd)[a,b]

[a] *Department of Anesthesiology and Perioperative Medicine, Penn State Health Milton S. Hershey Medical Center, Hershey, PA, USA*

[b] *Medical Simulation Center, Penn State Health Milton S. Hershey Medical Center, Hershey, PA, USA*

E-mail address: mandreae@pennstatehealth.psu.edu (M.H. Andreae).

[*] Corresponding author at: Department of Anesthesiology, Penn State Milton S. Hershey Medical Center, 500 University Drive, Hershey, PA 17033, USA.