Virtual Simulation Experiences in an Emergency Medicine Clerkship:
Novel Approaches to Simulation-Mediated Education in the Setting of COVID-19

Shruti Chandra, MD
Chaiya Laoteppitaks, MD
Alan Cherney, MD
Xiao Chi Zhang, MD
Dimitrios Papanagnou, MD

Sidney Kimmel Medical College, Thomas Jefferson University, Philadelphia PA
Corresponding author: shruti.chandra@jefferson.edu

Background: The COVID-19 pandemic not only extricated medical students from the clinical learning environment (CLE), but also restricted students from attending on-campus education, such as didactic lectures, workshops, and simulations. This posed a significant problem to the Emergency Medicine (EM) Clerkship at the Sidney Kimmel Medical College (SKMC) at Thomas Jefferson University (Jefferson), as simulation remains the featured cornerstone of the rotation. Over the course of the clerkship, students participate in workshops, procedural skills training and high-fidelity simulations that objectively link to systems-based practice and problem-based learning and improvement.

The EM clerkship is one of the few rotations that leverages simulation to its fullest learning potential. The literature is replete with the downstream effects that simulation has on its learners. Simulation replicates real-life, high-stakes, low-frequency events for learners, and affords the educator the ability to control the signal-to-noise ratio depending on the level of the learner. Pedagogically, when executed correctly, simulation can augment learner clinical autonomy, decision-making, task-switching, and information-processing. Simulation also affords the instructor the opportunity to assess learner skills using a competency-based approach.

In this document, we describe a novel clinical simulation experience for senior medical students in an EM clerkship that fulfills clinical course learning objectives, while still providing students the opportunity to experience simulation-based learning. We also describe the tools we used to convert the rest of our curriculum to an online platform.

Goal: To provide students in the Emergency Medicine clerkship with simulation-based opportunities that support task-switching, information processing, decisional autonomy, and procedural knowledge.

Learning Objectives:
The educational innovation addressed the following student learning objectives:

- Demonstrate appropriate initial evaluation and assessment of patients presenting to the Emergency Department with urgent and emergent medical and traumatic conditions.
- Organize information gathered from the interview, physical examination, and diagnostic work-up to appropriately formulate reasonable hypotheses and differential diagnoses.

- Formulate management strategies that: are consistent with the acuity of a patient's illness; incorporate the patient's interests, needs, and preferences; and are mindful of resource utilization.
- Construct safe, appropriate, and evidence-based disposition plans for a wide range of clinical conditions common to the practice of Emergency Medicine.

Resources: Smartphone, computer, or tablet device; Zoom account, Blackboard Collaborate, access to Case Files Emergency Medicine, Resuscitation! app, Full Code app

Description:
At Jefferson, Emergency Medicine is a required clinical rotation for all medical students in the fourth year of their training. The curriculum affords students the opportunity to participate in high-fidelity simulations at the Rector clinical skills and simulation center with faculty facilitators. Students typically perform three immersive, team-based simulations in groups, which are followed by a detailed debriefing on medical management and decision-making. Clerkship directors also leverage simulation as an assessment tool, ensuring that students execute a number of critical actions for each case that is simulated. The curriculum also ensures that students practice procedures that are commonly performed in the ED.

Emergency Medicine clerkship leadership had to quickly identify creative ways to migrate the curriculum to a virtual, online format. To this effect, several creative innovations were identified to fulfill course goals and objectives.

Independent study:
- **Case Files: Emergency Medicine** (Toy, Simon, Takenaka, Liu, Rosh; McGraw-Hill Education, 2017) book is digitally available to all students through the Jefferson. Clerkship faculty curated a list of 20 cases to provide students with a broad array of chief complaints and diagnoses representative of the ED clinical experience and fulfill the requirements for the Patient Encounter Logging System.
- The **Resuscitation!** App, available for both Apple and Android devices, was used to deliver virtual simulations Students were asked to download the application on their respective devices at the start of the rotation device. Students were required to complete 7 cases; these cases were available for free on the app. At the end of the simulation, the app automatically provides students with the number of critical actions successfully executed by the student, including feedback on the differential diagnoses and final diagnosis selected, as well as feedback on the disposition decision (admission, discharge). Students were asked to submit a screen shot of the final page for each Resuscitation! Case completed for faculty review.
- Students also received a virtual didactic curriculum with pre-recorded lectures and EM podcasts vetted by the faculty. These also included NEJM procedural videos that review indications and contraindications, along with steps for each procedure.

Remote Virtual Interactions Facilitated by Faculty:
- Students performed six tabletop clinical cases with an EM faculty member for 2-3 hours during the rotation through Zoom or Blackboard Collaborate. These were conducted in

small groups with 5-6 students per faculty member, after which students were debriefed on their medical decision making and a review of the critical actions met.

Assessment:

- Faculty used a virtual simulation app called Full Code (https://app.full-code.com/Player/Player.html) that is available on both mobile device and computer browser. Full Code provides a realistic environment that immerses the student in ED, allowing him/her to evaluate a patient through collecting a history and performing a physical examination. The student can resuscitate the patient and perform interventions to improve the patient's clinical status. To complete each case, the student is asked to generate a differential diagnosis, plan of treatment, and select a final disposition. Faculty remotely observed students' screen as they navigated each case, providing preceptors with insight into students' decision-making.
- Within the case, the students were expected to 'perform' procedures by reviewing indications and enumerating all its steps that were checked against a checklist.

Attached in the appendix are the resources identified above.

Our Experience:

We have implemented this experience for both junior and senior medical students at SKMC. The curriculum has been a resounding success.

One of our early challenges was identifying means to address and assess teamwork and communication through this modality. Students have provided positive feedback and reported that having the opportunity to 'perform' an history and 'manage' a patient was helpful to simulate the clinical environment. The virtual platform for performing simulations was also well received. It was an easy platform for faculty to navigate. Students appreciated the immediate feedback provided by each of the applications. Students also appreciated the opportunity to deliberately practice cases incorporating feedback received.

As faculty observed Full Code cases, they were able to observe actions/decisions that took students longer to execute and identify at what points of the case they started to struggle. Faculty were also able to observe the order in which they performed actions, and what part of the resuscitation and management they prioritized. In earnest, this afforded clerkship leadership a deeper understanding of students' clinical decision-making and management skills.

Appendices:

1. Screen shots from Resuscitation! app
2. Screen shots from Full Code