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International Virtual Simulation Education in Critical Care During COVID-19 Pandemic: Preliminary Description of the Virtual Checklist for Early Recognition and Treatment of Acute Illness and iNjury Program

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Summary Statement: The Checklist for Early Recognition and Treatment of Acute Illness and iNjury program is a well-established, interactive, and simulation-based program designed to improve the quality of care delivered in intensive care units. The COVID-19 pandemic created an overwhelming surge of critically ill patients worldwide, and infection control concerns limited healthcare providers' access to in-person and hands-on simulation training when they needed it the most. Virtual simulation offers an alternative to in-person training but is often complex and expensive. We describe our successful development and initial implementation of an inexpensive, simulation-based virtual Checklist for Early Recognition and Treatment of Acute Illness and iNjury program to address the pressing need for effective critical care training in various resource-limited settings both within and outside of the United States. The overall satisfaction rate ("excellent" or "very good" responses) was 94.4% after the virtual simulation workshop. Our initial experience suggests that virtual interactions can be engaging and build strong relationships, like in-person continuing professional education, even using relatively simple technology. This knowledge-to-practice improvement platform can be readily adapted to other disciplines beyond critical care medicine. (*Sim Healthcare* 17:205–207, 2022)

Key Words: Virtual simulation, critical care, international education, interprofessional education.

PROBLEM

Consistent implementation of evidence-based best practices remains variable across healthcare settings, causing notable differences in care delivery and outcomes in critical care unexplained by seriousness of illness. Standardization of practice and education may help improve quality of care; that is why we developed the Checklist for Early Recognition and Treatment of Acute Illness and iNjury (CERTAIN) program (<http://www.icertain.org>). The CERTAIN approach has used simulation experiences to engage clinicians and reduce errors of omission using a

simple checklist. In a recent multinational study, the CERTAIN was associated with better adherence to best practice of critical care processes and improved patient outcomes in 34 intensive care units (ICUs) from 15 countries.

To disseminate the CERTAIN approach to clinicians worldwide, we had developed a low-cost, feasible course using remote simulation, which because of the COVID-19 pandemic was recently evolved into a virtual simulation experience. Virtual simulation has been described in the medical literature. Interestingly, in some cases, learner satisfaction even exceeded traditional

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Y.D. received remote simulation research grant from Mayo Clinic. O.G. has financial conflict of interest with CERTAIN software platforms licensed to Ambient Clinical Analytics. O.G. also received an education grant from the World Health Organization Office in Sarajevo, Bosnia and Herzegovina. R.K. receives funding from the National Institutes of Health/National Heart, Lung and Blood Institute (R01HL 130881, UG3/UH3HL 141722), Gordon and Betty Moore Foundation, and Janssen Research & Development, LLC; and royalties from Ambient Clinical Analytics, Inc. They had no influence on acquisition, analysis,

interpretation, and reporting of pooled data for this article. The other authors declare no conflict of interest.

This research was partially funded by a remote simulation research grant from Mayo Clinic and an education grant from the World Health Organization Office in Sarajevo, Bosnia and Herzegovina.

This work is attributed to the Mayo Clinic in Rochester, Minnesota.

Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site (www.simulationinhealthcare.com).

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DOI: 10.1097/SIH.0000000000000656

models. However, these virtual simulations often involve complex software and limit human interaction. Conversely, our program aimed to use simulation experiences to increase engagement between trainer and learner. Building on a remote simulation experience that was developed in 2013, we developed a virtual educational program consisting of an on-line curriculum, followed by simulation with postintervention evaluation.

Our goal was to create a knowledge-to-improvement practice virtual platform to accelerate dissemination of the CERTAIN program internationally and promote interprofessional education with real-time conversation, which is essential to change clinical care practice. Accordingly, we provided an inexpensive, easily scalable virtual simulation training experience using readily available technology.

In September 2020, we held our first train-the-trainers course, followed by the first virtual course in October 2020 in Croatia. Since then, 4 additional international centers from China, Vietnam, Bosnia, and Montenegro have enrolled in the virtual CERTAIN course along with 11 hospitals from the United States. Here, we present the results of the 3 first virtual simulation courses that were completed and involved 156 learners.

SOLUTION

To redesign the virtual CERTAIN course, we used the Analysis-Design-Develop-Implement-Evaluate or ADDIE framework. The blended program included on-demand didactic webinars, virtual simulation, and case discussion to reinforce the online content.

In the analysis phase, we wanted to adapt our learning objectives and expected outcomes with input from participants. For this, we created a “needs assessment” step that consisted of surveys and group interviews (see Figure, Supplemental Digital Content 1, <http://links.lww.com/SIH/A801>), which represents the new process for our virtual simulation model. After the interviews, we were able to customize the course to the participants' goals and expectations. These changes included translation of the curriculum, the checklists, and the virtual course into their native language, as well as adaptation of the topics discussed to reflect participants' goals and adjustments of the course to the cultural differences of their clinical practice. Our multidisciplinary team consists of critical care physicians, research scientists, nurses, respiratory therapists, and research fellows from several countries. Diverse culture backgrounds and linguistic capabilities empowered us to make the previous changes in the CERTAIN program and keep participants engaged virtually.

The design and development phase consisted of curriculum development, selecting the appropriate simulation platform, and individualizing the course. The asynchronous, online didactic material comprising the core modules was disseminated via the Blackboard LMS platform (Reston, VA.).

The checklist was first tested on a cohort of clinicians from our institution before implementation. Multiple remote simulation configurations were trialed (Google Hangout, Skype, Zoom, etc) from 2013 to 2017. During our simulation training, learners gathered in their own facility and used videoconferencing software to connect with faculty. Starting in 2016, our research team conducted multiple in-person simulations

course globally. However, this increased funding requirements and limited the scalability of the project.

With the COVID-19 pandemic, our team transitioned to virtual simulation in recognition of the high demand for rapid dissemination of CERTAIN. We chose to host the virtual meeting through Zoom (San Jose, CA), using Articulate e-learning software (New York, NY; <https://articulate.com/>) to deliver the simulation (see Figure, Supplemental Digital Content 2 <http://links.lww.com/SIH/A802>, which demonstrates the evolution of simulation scenarios until now). For virtual conference, we had tried Google hangouts and Skype but none of them offered the quality, flexibility, and popularity of Zoom. We chose Articulate because it is a very straightforward and user-friendly platform, which helped us transition quickly to our virtual simulation. Therefore, learners and faculty were able to participate from anywhere with a reliable Internet connection.

A pilot train-the-trainer course for CERTAIN faculty was conducted in September 2020 offering the opportunity for faculty to familiarize themselves with core CERTAIN simulation instruction techniques and the new technology platform. The trainers were provided with necessary material, so they could teach the program on their own (see Figure, Supplemental Digital Content 1 <http://links.lww.com/SIH/A801>, which represents the new process for virtual simulation model).

The first virtual simulation course took place in October 2020. Learners received access to all online course materials 2 weeks before a half-day virtual course that included a concise review of the online content and a series of virtual simulations where they applied the CERTAIN admission and rounding process to virtual case scenarios followed by debriefing (see Video, Supplemental Digital Content 3 <http://links.lww.com/SIH/A803>, which demonstrates a demonstration of the virtual simulation). Our team was cognizant of the importance of keeping the group engaged virtually. After introduction/prebriefing with all participants, we divided the class into breakout rooms, creating a safe and educational environment for virtual simulation practice and debriefing. The experience concluded with a large group discussion of implementation approaches and an interactive discussion led by a blended panel of CERTAIN faculty and local leaders on common controversies in critical care practice. The topic of this discussion was decided based on live polls to identify which topics the audience was interested in (airway management, shock, COVID-19, etc).

EVALUATION

Program evaluation was conducted using the Kirkpatrick model. Learner engagement and reaction (Kirkpatrick level 1) was evaluated by tracking time spent studying on-demand training material on an individual basis. Furthermore, a post-attendee survey was built using a 5-point Likert scale, and the answers from the 156 participants were collected anonymously, which revealed the overall ratings of the virtual simulation workshop as predominantly “excellent” or “very good” (94.4%; see Table, Supplemental Digital Content 4 <http://links.lww.com/SIH/A804>, which demonstrates the evolution of simulation scenarios until now).

Learning, behavior as the adherence to care practice, and patient outcomes (Kirkpatrick Levels 2,3,4) will be measured and evaluated in the 6-month postcourse as previously done.

Indeed, we are now working with those hospitals to collect process of care and patient outcome as outcome measures.

CONCLUSIONS

Overall, our experience taught us that the most important steps in starting to develop a virtual simulation course could be summarized as follows:

- Create a strong open-minded core team willing to learn.
- Listen to learner needs to adapt the program to them and to support their engagement.
- Insist on getting feedback from learners to improve the program
- A train-the-trainer course is crucial to developing core faculty competence to lead a large-scale, virtual simulation program.

Framing the course development with the ADDIE steps has enabled us to use the course in an all-virtual mode. Moreover, we adapted the course to each center based on their needs, expectations, and cultural differences. Inspired by a disruptive innovation concept, we delivered a simple and low-cost alternative to conventional simulation and education that can be used in all settings, from low- to higher-income countries.

ACKNOWLEDGMENTS

The authors thank Nika Zorko Garbajs, MD, for her participation to the virtual simulation course and Andreja Radosavljevic for editing the video content, as well as all trainers from our institution and participants from different hospitals around the world.