Designing Sustainable Solutions to Implement a Distance-Based Simulation Basic Life Support Training Program During COVID-19 Pandemic in Low-Income Countries

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Summary Statement: The global pandemic of COVID-19 had strong repercussions in healthcare simulation-based education around the world. Different adaptations to imposed restraints such as social distancing have been developed to address the educational needs of healthcare professionals. However, the lack of access to simulators in low-income countries or rural areas may restrict the access to distance simulation-based training.

PROBLEM

During the COVID-19 pandemic, simulation emerged as an invaluable healthcare training tool. At the same time, imposed restraints such as social distancing forced different adaptations to conduct educational programs, such as video conferencing software, social media platforms, and Free Open Access Medical education tools.

Our simulation group successfully developed a platform for distant-access motor skills training using simulation with remote and asynchronous feedback. This platform provides feedback capacity maintaining a safe physical distance between learners and faculty. In this context, the Ministry of Foreign Affairs of our country asked us to implement basic life support (BLS) courses for several Caribbean islands to train healthcare professionals of low-income countries during the COVID-19 pandemic using this methodology.

The process of developing distant-access motor skills training requires 3 fundamental pillars: a training program, an instructor network to provide feedback, and a simulator to conduct the training session. In today’s context, with the development of virtual platforms and international collaboration, the first two can be properly addressed. The third component, adequate access to simulators, remains unsolved mainly because of economic restraints.

One promising way to address this problem is to integrate methodologies from the field of design and anthropology, such as distributed manufacturing processes, which may facilitate participants to create their own homemade simulators.

The aim of this article is to describe how we developed a design-based solution to implement a distant-access BLS training program using simulation during the COVID-19 pandemic in remote areas.

SOLUTION

Through collaboration between the schools of design and medicine of our university, an R&D contest was launched aiming to provide affordable simulators to remote areas.

The project of manufacturing a low-cost manikin was presented as a contest to third-year undergraduate studying design at our university, in a challenge format. Five teams composed by 2 students were enrolled in the contest. Within 2 weeks, each team had to provide a solution for constructing a BLS low-cost manikin with homemade materials.

Instructions were given as follows:
1. The final product should allow for adequate cardiopulmonary resuscitation technique (bag-mask ventilation and cardiac compressions).
2. The final product should conform to the anatomy of an average adult person.
3. The construction of the simulator should be able to be carried out with accessible and affordable materials for multiple Latin American contexts. Materials should not be difficult to obtain and, ideally, should be available at home or nonspecialty stores.
4. It should be possible to manufacture without the need for special tools.

We received 5 projects to create 5 homemade BLS manikins, including different materials, construction time, and direct costs. The 5 manikins were built with low-cost materials and simulated ventilation and chest compressions maneuvers. (See figure, Supplemental Digital Content 1, http://links.lww.com/SIH/A827, which demonstrates the 5 manikins). During a videoconference meeting, each team presented an instructional video about "how to assemble" their manikin and provided a detailed step-by-step construction manual.

**SIMULATOR ASSESSMENT**

Three experts developed an assessment tool through a 2-round iteration process. The assessment tool consists of a 5-point Likert scale containing 8 items that evaluate 4 dimensions: construction time, materiality, functionality, and a global appreciation score (See table, Supplemental Digital Content 2, http://links.lww.com/SIH/A828, which demonstrates BLS phantom evaluation guideline). The testing of the simulators was done by 10 experts from the anesthesia, emergency, and intensive care departments of our university (See table, Supplemental Digital Content 3, http://links.lww.com/SIH/A829, which presents total score of each expert). Total scores ranged between 15 and 40 points, with an average of 29.8 and a median value of 31. The highest score obtained defined the winner. The winner was manikin number 2 with a total median score of 34.5 points. A short video detailing the construction and assembly process of the manikin was uploaded on the platform of our BLS course.

**LESIONS LEARNED**

Different formats of distance-based simulation training have been developed in the healthcare simulation field to continue with academic activities despite social distance and movement restrictions. As a sign of the times, the Society for Simulation in Healthcare proposed a number of terms to describe these new distance-based formats. These new formats have been successfully used in training communication and motor skills, either with synchronous or with asynchronous feedback.

A fundamental part of distance-based motor skill training is having an adequate simulator at the students' training site. Current alternatives include buying a simulator, transporting it by courier, or building it at home or workplace. Commercial simulators are expensive, and courier transport can take over 2 months and includes variable expenses such as customs and airfare, making them less attractive for low- and middle-income locations.

Interdisciplinary networks that include medicine, design, and engineering allow the development of this type of R&D innovations. The rapid response of teachers and students from these areas becomes essential to develop solutions with functional and sustainable designs.

This approach has several limitations. First, because manikins were not manufactured by commercial companies, the products' construction quality cannot be assured and will depend entirely on the users' compliance with assembly instructions. This fact initially made us question whether skills achievement could be potentially hindered. However, we still carried out the intervention, considering that the literature supports simulation training when it is compared with no training.

Resilience during the pandemic has required that simulation programs develop innovative approaches at a previously unimaginable pace, often without the ability to fully evaluate them before implementation. Future research should be conducted to compare classic onsite training against these new training methodologies, including remote asynchronous feedback and phantoms manufactured by trainees.