The Feasibility of a Pediatric Distance Learning Curriculum for Emergency Nurses During the COVID-19 Pandemic: An Improving Pediatric Acute Care Through Simulation Collaboration

Authors: Anita A. Thomas, MD, MPH, Erin E. Montgomery, RN, BSN, CCRN, Kamal Abulebda, MD, Travis Whitfill, PhD, MPH, MPhil, James Chapman, BSE, James Leung, MD, Jabeen Fayyaz, MD, DCH, MCPS, FCPS, MHPE, and Marc Auerbach, MD, MSc, Seattle, WA, Indianapolis, IN, New Haven, CT, New Brunswick, NJ, and Hamilton and Toronto, Ontario, Canada

Contribution to Emergency Nursing Practice

- Pediatric emergency medicine education was challenging during the COVID-19 pandemic because of the need to focus educational efforts on COVID-19 in adults.
- The curriculum was feasible for nurse educators and demonstrated high satisfaction and improvement in knowledge and critical actions among nurses who completed it.
- A continuing education nursing curriculum including telesimulation and brief asynchronous weekly educational activities facilitated by nurse educators, with support from the Improving Pediatric Acute Care Through Simulation collaborative, can improve general emergency medicine nurses' knowledge on pediatric topics and performance during telesimulations while maintaining physical distancing.

Abstract

Introduction: To develop and evaluate the feasibility and effectiveness of a longitudinal pediatric distance learning curriculum for general emergency nurses, facilitated by nurse educators, with central support through the Improving Acute Care Through Simulation collaborative.

Methods: Kern's 6-step curriculum development framework was used with pediatric status epilepticus aimed at maintaining physical distancing, resulting in a 12-week curriculum bookended by 1-hour telesimulations, with weekly 30-minute online asynchronous distance learning. Recruited nurse educators

Anita A. Thomas is an Associate Professor, Division of Emergency Medicine, Department of Pediatrics, University of Washington, Seattle Children's Hospital, Seattle, WA. **Twitter:** @yourbabydoctor. **ORCID identifier:** https://orcid.org/0000-0001-7031-8020.

Erin E. Montgomery is a Critical Care Transport Nurse, Department of Pediatrics, Improving Pediatric Acute Care Through Simulation, Riley Children's Hospital, Indianapolis, IN. **Twitter:** @erinmonty12. **ORCID identifier:** https://orcid.org/0000-0003-2572-8834.

Kamal Abulebda is an Associate Professor, Division of Critical Care, Department of Pediatrics, Indiana University School of Medicine, Riley Children's Hospital, Indianapolis, IN. **Twitter:** @kabulebda. **ORCID identifier:** https://orcid.org/0000-0002-7372-2632.

Travis Whitfill is an Assistant Professor Adjunct, Department of Pediatrics and Department of Emergency Medicine, Yale School of Medicine, New Haven, CT. **Twitter:** @twhitfill. **ORCID identifier:** https://orcid.org/0000-0002-3277-4380.

James Chapman is a Medical Student, Clinical Academic Building, Rutgers Robert Wood Johnson Medical School, New Brunswick, NJ. **ORCID identifier:** https://orcid.org/0000-0002-4750-9926.

James Leung is an Assistant Professor, Division of Pediatric Emergency Medicine, Department of Pediatrics, Health Sciences Center, McMaster University, Hamilton, Ontario, Canada. **Twitter:** @drjscleung. **ORCID identifier:** https://orcid.org/0000-0002-4426-0803.

Jabeen Fayyaz is an Assistant Professor, Division of Emergency Medicine, The Hospital for Sick Children, Toronto, Ontario, Canada. **Twitter:** @jabfay. **ORCID identifier:** https://orcid.org/0000-0002-2560-9926.

Marc Auerbach is a Professor, Division of Pediatric Emergency Medicine, Department of Pediatrics, Department of Emergency Medicine, Yale School of Medicine, New Haven, CT. **Twitter:** @drauerbach. **ORCID identifier:** https://orcid.org/0000-0002-3796-4300.

For correspondence, write: Anita A. Thomas, MD, MPH; E-mail: anita.thomas@seattlechildrens.org

J Emerg Nurs 2023;49:27-39.
Available online 9 September 2022
0099-1767

https://doi.org/10.1016/j.jen.2022.09.001

recruited a minimum of 2 local nurses. Nurse educators facilitated the intervention, completed implementation surveys, and engaged with other educators with the Improving Pediatric Acute Care through Simulation project coordinator. Feasibility data included nurse educator project engagement and curriculum engagement by nurses with each activity. Efficacy data were collected through satisfaction surveys, pre-post knowledge surveys, and pre-post telesimulation performance checklists.

Results: Thirteen of 17 pediatric nurse educators recruited staff to complete both telesimulations, and 38 of 110 enrolled nurses completed pre-post knowledge surveys. Knowledge scores improved from a median of 70 of 100 (interquartile range: 66-78) to 88 (interquartile range: 79-94) ($P = .018$), and telesimulation performance improved from a median of 60 of 100 (interquartile range: 45-60) to 100 (interquartile range: 85-100) ($P = .016$). Feedback included a shortened intervention and including physician participants.

Discussion: A longitudinal pediatric distance learning curriculum for emergency nurses collaboratively developed and implemented by nurse educators and Improving Pediatric Acute Care through Simulation was feasible for nurse educators to implement, led to modest engagement in all activities by nurses, and resulted in improvement in nurses' knowledge and skills. Future directions include shortening intervention time and broadening interprofessional scope.

Key words: Pediatrics; Nursing education; Telesimulation; Simulation training; Emergency nursing

Introduction

Most acutely ill and injured children are cared for in general emergency departments that concurrently care for children and adults.[1] Many general emergency departments have low pediatric patient volumes and are not well prepared to care for children, as noted by low weighted pediatric readiness scores (WPRSs) and in challenges with balancing pediatric and adult educational topics, resulting in variability in the quality of pediatric care.[2-5] Nurse educators have 2 distinct audiences/learner groups for their pediatric education: experienced nurses requiring continuing education and initial training for new graduates starting in practice. Prepandemic pediatric education in general emergency departments typically involved nurses participating in high-quality, intensive 8- to 16-hour pediatric courses, through organizations such as the Emergency Nurses Association (ENA) (Emergency Nursing Pediatric Course, Emergency Severity Index Pediatric Triage Course, Certified Pediatric Emergency Nurse Course)[6] and the American Heart Association (Pediatric Advanced Life Support, Pediatric Emergency Assessment Recognition and Stabilization).[7] In addition, an increasing number of online asynchronous continuing education activities, such as those offered through ENA University, have been created for emergency nurses.[8] Emergency nurse educators often augmented these courses and asynchronous activities with in-person educational activities including bedside education, lectures, simulations, skills-training, competency fairs, and workshops.

The pandemic created many new challenges for nurse educators, including financial cuts, the need to prioritize COVID-19 related topics, limitations in staffing with an increase in travel nurses, increasing burnout among emergency nurses, and physical distancing rules limiting traditional in-person educational activities.[9-11] Additional challenges specific to pediatric education during the pandemic included limited or no access to the existing in-person courses (Emergency Nursing Pediatric Course, Pediatric Advanced Life Support) and further reductions in pediatric patient volumes.[12-15] As the pandemic persisted, nurse educators reached out to our Improving Pediatric Acute Care through Simulation (ImPACTS) collaborative with requests for ideas and resources to conduct pediatric education in the face of barriers created by the pandemic. ImPACTS is a national network of children's hospitals collaborating with general ED physician and nurse educators to improve the quality of pediatric care.[16,17] The ImPACTS network involves a hub-and-spoke model of continual collaboration including in situ simulation, education, and quality improvement initiatives among 36 children's hospitals (the ImPACTS regional "hubs") and over 200 local general emergency departments (the "spokes"). Prepandemic ImPACTS involved collaborations between nurse educators in general emergency departments with their regional hub ImPACTS teams to implement pediatric educational and improvement efforts. A cornerstone of the ImPACTS program is that the team aims to work collaboratively "with" the nurses in these emergency departments and not work "on" them. These ImPACTS projects involved hub sites physically traveling to regional spoke community emergency departments to collaborate on in situ pediatric simulation, pediatric acute care

TABLE 1
Learning objectives

Team-centered care	➢ Verbally describe necessary staff, equipment, and resources to care for a seizing pediatric patient recognizing pediatrics status epilepticus
	➢ Demonstrate effective teamwork and communication
	○ Shared mental model
	○ Directed orders
	○ Closed loop communication
Family-centered care	➢ Demonstrate family-centered care via
	○ Obtain the appropriate history from a family member
	○ Address family concerns
	○ Keep the family updated
Clinical knowledge	➢ Describe the initial management of an acutely ill pediatric patient
	○ Prioritize airway, breathing, circulation
	○ Describe first line diagnostics and therapies with alternate route (intranasal vs intramuscular)
	○ State need for transfer to tertiary pediatric care center

education, and pediatric quality improvement initiatives. Scholarship on ImPACTS projects has demonstrated improvements in pediatric emergency readiness and improved adherence to evidence-based guidelines during the care of simulated critically ill pediatric patients in participating general emergency departments.[18-21]

In response to requests from ImPACTS affiliated nurse educators, ImPACTS collaborated with our general emergency nursing colleagues to initiate a project with 3 main goals: (1) to collaborate with general emergency nurse educators on the development and implementation of a curriculum for pediatric nursing education that could be implemented during the pandemic, (2) to determine the feasibility of the curriculum for nurse educators to administer and learners to participate in during the pandemic, and (3) to describe the effectiveness of the curriculum on improving participants' comfort, knowledge, and skills. We believed that the curriculum would be feasible for educators to implement and for participants to engage with and improve participants' knowledge and skills.

Methods

CURRICULUM DEVELOPMENT

Kern's 6 step curriculum development framework was used for this project as described below:[22]

Generalized Needs Assessment

During COVID-19, pediatric acute care was identified as an educational gap for general emergency nurses by existing nurse educators or pediatric emergency care coordinators (PECCs) through the ImPACTS network. This gap was attributed to the challenges articulated in the introduction section and supported by previous research.[2,23]

Targeted Needs Assessment

A targeted needs assessment was conducted via ImPACTS with a group of existing general emergency nurse educators or PECCs through phone calls, emails, and video-conferencing discussions with the central ImPACTS team. These discussions focused on specific nursing continuing educational needs and revealed a desire for targeted pediatrics topic areas as opposed to broad pediatrics content. The initial management of pediatric status epilepticus was specifically identified as a high priority topic, mirroring previous needs assessments.[23,24]

Goals and Objectives

Through the iterative process of the targeted needs assessment, specific learning objectives were identified related to the management of pediatric status epilepticus (Table 1).[25] These objectives align with the prior pediatric educational prioritization processes for emergency nurses including teamwork, clinical knowledge (triage, resuscitation protocols), and family-centered care.[25]

Educational Strategies

The selection of educational strategies centered on the need for physical distancing guidelines without in-person interactions. Educational strategies were selected based on existing guidelines that improve outcomes for resuscitation education.[26] These strategies included spaced practice (repetitive interactions over 12 weeks), contextual learning (working with local teams), feedback and debriefing (telesimulations), and innovative educational strategies (gamification, digital media). The distance learning approach with local collaboration by their nurse educator and colleagues enabled us

to meet learners and nurse educators where they were, often at home and over video-conferencing. This educational strategy allowed for repeated learning opportunities over time, created a combination of active and passive learning, and provided space for both individual and group learning.

Telesimulation was chosen to allow for an experiential simulation-based team-training while maintaining physical distancing in the setting of the pandemic.[24,27] Telesimulation has become a more readily available, safe, and cost-effective simulation platform as the pandemic has progressed as compared with in situ in-person simulation.[28-31] Distance learning also was chosen to allow for both synchronous and asynchronous learning. Participation was voluntary and limited to nurses, and recruitment was solicited by each site's nurse educator. Demographic data were collected, and pre/post knowledge tests were administered. Two telesimulation cases were created by content experts by adapting existing validated pediatric status epilepticus simulation scenarios via the American College of Emergency Physicians (ACEP)'s SimBox.[32] The cases' critical action checklists were adapted from existing pediatric seizure guidelines.[33,34] Cases were piloted by a group of interprofessional providers at 2 academic pediatric emergency medicine sites, as well as community emergency departments. The cases were intended for formative education with the goal of face, content/construct validity through prior use with ACEP SimBox and use of a pilot/feedback with iterative improvement. The telesimulations were conducted as the first and final elements of the intervention, with facilitation by a pediatric emergency nurse and another pediatric content expert (nurse or physician) as per guidelines from the International Nursing Association for Clinical Simulation and Learning,[35] the Promoting Excellence and Reflective Learning in Simulation blended framework,[36] and telesimulation debriefing best practices.[37] Author E.E.M, who served as the project coordinator, is a skilled and experienced debriefer, who trained each site's PECC before both the first and second telesimulations, was present for each telesimulation, and met with PECCs regularly. The telesimulations featured a prerecorded internet-based streamed video (see Supplementary Appendices 1-3) with an orientation, emergency medical services patch, actor with status epilepticus, and vital signs monitor, thus allowing facilitators to toggle the video stream back and forth as needed to respond to real-time interventions.[32,38] The telesimulation cases ran for a total of 30 minutes, including a prebriefing, simulation, and debriefing. Facilitators were provided with the critical action checklists to ensure that participants met the goals of initial management of pediatric status epilepticus.

In between telesimulations, nurse educators were provided with weekly free open-access medical education components of the intervention for distribution to their sites' participating nurses. This content was selected and vetted by ImPACTS content experts in collaboration with participating nurse educators before the study. This process focused on the need for content to be consistent, of brief duration (<20 minutes), of high educational quality, and of diverse instructional design. This included didactic lectures, skills demonstrations, choose your own adventure learning platforms, podcasts, learning modules, and skills demonstration (Figure 1). Recognizing that the intervention was lengthy, we attempted to provide a break during weeks 8 or 9. In addition, some pediatric educators were supported in running their own telesimulation during either of those weeks.

Implementation

Recruitment/enrollment. General emergency nurse educators from lower volume emergency departments that care for both children and adults were recruited via email to existing ImPACTS contacts and postings on ImPACTS social media channels during June and July 2020. Pediatric emergency departments and pediatric emergency nurse educators were not recruited for this project and were excluded from enrollment. A priori, we aimed to enroll general emergency nurse educators who recruited a minimum of 2 nurse participants for a total goal of 12 individual nurse participants across 6 sites. Interested general emergency nurse educators were provided details about the project as described in the intervention section above and through brief meetings with the ImPACTS project coordinator (author E.E.M). If the general emergency department had an existing nurse PECC, they served as the primary contact point. If the general emergency department did not have a PECC, they were asked to identify whether they or someone else on their team would serve as the primary contact point for the project.

Nurse Educator Role. Nurse educators were supported by the ImPACTS project coordinator who provided curricular content, training in simulation-based education, and biweekly discussion sessions. Educators facilitated but did not participate in telesimulations and did not complete evaluation metrics. Each educator recruited a minimum of 2 other volunteer nurse participants and participated in a train-the-trainer session facilitated by the study team.

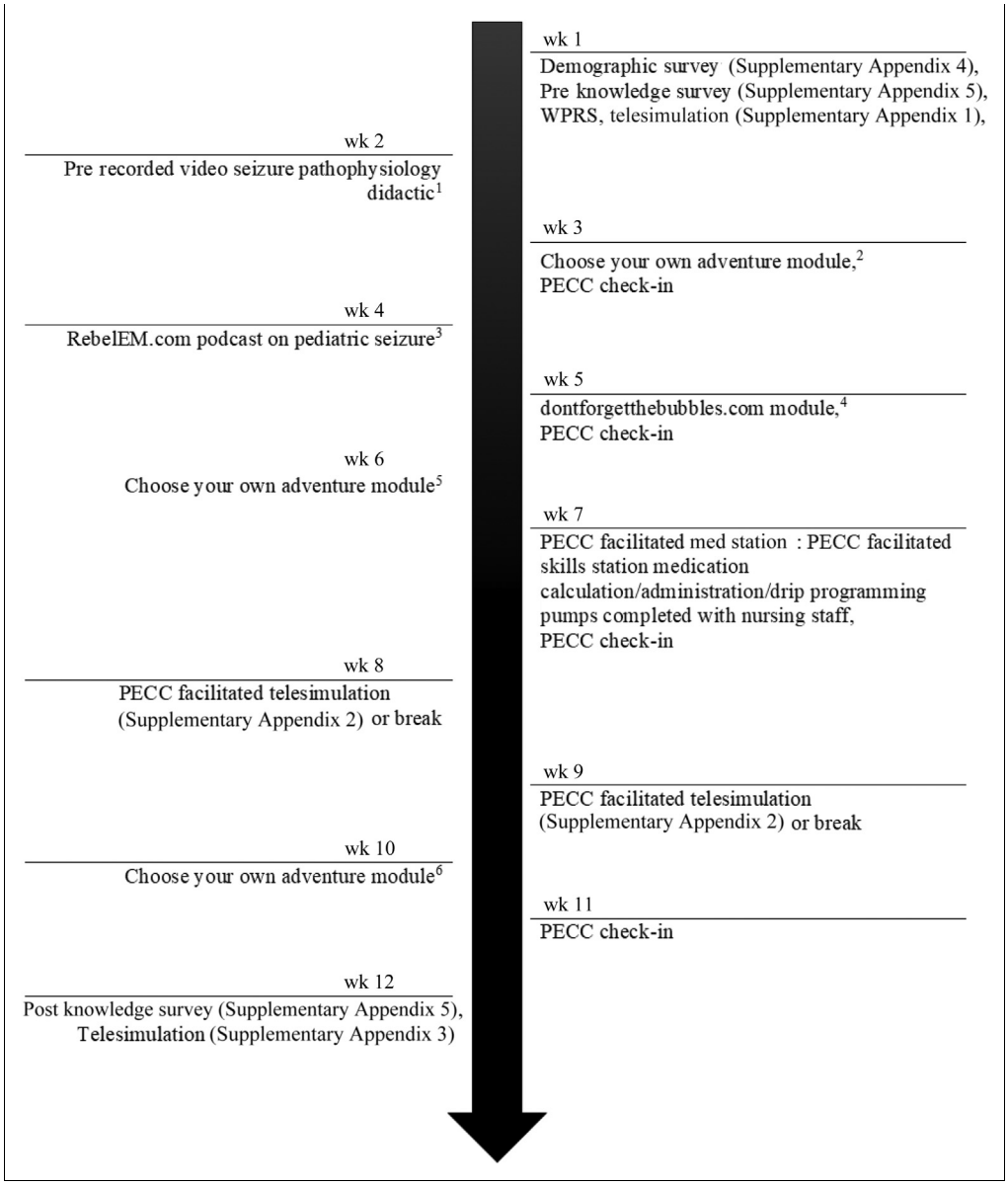

FIGURE 1

Project timeline. PECC Check-in = 30 min virtual meeting with study team and other participating PECCs.[39-44] WPRS, weighted pediatric readiness score; PECC, Pediatric Emergency Care Coordinator.

Nurse educator train-the-trainer. A 1-hour-long virtual training was conducted before the start of the intervention at each site and was facilitated by the ImPACTS project coordinator with individual or groups of participating nurse educators. The session included (1) outlining the expectations of the educators during the intervention, (2) outlining the curriculum for their learners, including a thorough review of the telesimulation platform and the expectation to review each of the weekly distance learning activities, and (3) outlining information on pediatric readiness and the National Pediatric Readiness Project (NPRP) survey that the nurse educator at each site completed during the intervention. The NPRP is a multiphase national collaborative improvement initiative aiming to ensure pediatric readiness, as measured by an emergency department's adherence to the joint policy

statement for the care of children in emergency departments endorsed by the American Academy of Pediatrics, ACEP, and ENA.[4,6,7] The project coordinator also highlighted that many emergency departments are not well prepared to care for children, as noted by their low weighted pediatric readiness score, resulting in variability in the quality and outcomes of pediatric care.[1-3] Finally, the group discussed the importance for the nurse educator to serve in the role of a nurse PECC or recruit a colleague for this position.

A nurse PECC is a registered nurse who possesses special interest, knowledge, and skill in the emergency nursing care of children.[6] The nurse PECC can come from various backgrounds and may need additional support to develop and/or implement pediatric educational activities. The nurse PECC role includes facilitating pediatric-specific elements of orientation, continuing education, and competency evaluations. In addition to pediatric education and competency, nurse PECC responsibilities can include pediatric quality improvement in the emergency department, collaborating with pediatric care committees both in hospital and out of hospital, promoting pediatric disaster preparedness, and working with ED leadership to ensure availability of pediatric equipment, resources, policies, and procedures. The PECC is designated by leadership and may have other clinical or administrative roles in the emergency department (such as an educator) and works collaboratively with the general nurse educator and physician PECC. The joint policy statement states that all emergency departments should designate both a physician and a nurse PECC.[5,6] Despite this recommendation for a designated PECC to improve pediatric readiness, only 59% of emergency departments have a nurse PECC, and 48% have a physician PECC.[5] After reviewing this, the project coordinator shared data on the association of designating a PECC with significant improvements in pediatric readiness.[5,6]

Nurse educator support/community of practice. In addition to the train-the-trainer session, educators met virtually biweekly with the project coordinator and other participating educators to address program barriers and note successes. This was used as central support for educators and as a medium for a community of practice. In this way, the study team aimed to collaborate with sites as opposed to solely providing resources.

Evaluation and Feedback

Demographic data were collected from nurse educators and each participating nurse at the start of the intervention. The nurse educator presurvey collected demographic data

TABLE 2
Pediatric emergency care coordinator/nurse educator reported presurvey

Questions	*N* = 13	%
Approximate pediatric volume per d, median (IQR)	21 (5-35)	N/A
Affiliation with AMC	6	46
PALS is required for staff	9	69
PECCs had written job descriptions and responsibilities for their role	4	31
PECCs receive dedicated time for their role	4	31
Ongoing pediatric competencies (skills and/or knowledge) exist for your emergency nursing staff	11	85
PECCs are involved in ED pediatric quality improvement initiatives	7	54
PECCs assist in review of ED policies and procedures related to standards for medication, equipment, and supplies for pediatric patients	7	54
PECCs coordinate with local pediatric credentialing processes and facilitate pediatric competency evaluations for staff	5	39
PECCs serve as a liaison on in-hospital pediatric care committees (eg, trauma, emergency preparedness)	6	46
PECCs serve as a liaison on out-hospital pediatric care committees (eg, EMS)	4	31
PECCs serve as a liaison to local definitive care hospitals to integrate services along the pediatric care continuum	4	31
PECCs facilitate the inclusion of pediatric-specific elements to new ED staff on orientation	9	69
PECCs facilitate the integration of pediatric needs in-hospital disaster planning	3	23
PECCs collaborate with ED leadership to enable adequate staffing, medications, equipment and supplies, and other resources for children in the ED	8	62
PECCs have access to needed resources to adequately perform as a PECC in the ED	9	69
Pediatric simulations occur in the ED	9	69

IQR, interquartile range; AMC, academic medical center; PALS, pediatric advanced life support; PECC, Pediatric Emergency Care Coordinator; ED, emergency department; EMS, emergency medical services; N/A, not applicable.

TABLE 3
Pediatric emergency care coordinator/Nurse educator post survey

Questions	*N* = 10	%
How much pediatric-specific education was provided to your nurses pre-ImPACTS nursing distance learning collaboration?		
1-5 h per y	5	50
6-10 h per y	3	30
>10 h per y	2	20
Do you expect to conduct pediatric education in the coming year?		
Yes	10	100
If yes, do expect to conduct:		
The same amount of education as before	1	10
More education than before	9	90
Has your participation in the ImPACTS distance learning detracted from other nursing education?		
No	10	100
Was 12 weeks of curriculum		
Just enough	6	60
Too much	4	40
Do you have access to the resources you need to perform as a PECC in your ED?		
Yes	9	90
No	1	10
On a scale from 0-10, how likely are you to recommend the ImPACTS distance learning collaborative to a colleague? Median (IQR)	9 (8-10)	N/A

ImPACTS, improving pediatric acute care through simulation; PECC, Pediatric Emergency Care Coordinator; ED, emergency department; IQR, interquartile range; N/A, not applicable.

on the PECC role and ED characteristics and was completed with remote support from the project coordinator (Table 2). All sites had PECCs and had previously engaged with the ImPACTS collaborative with a median daily pediatric volume of 21. Whereas 11 of 13 or 85% of PECCs currently have ongoing pediatric competencies for emergency nursing staff, 5 of 13 or 39% coordinate with local credentialing processes and facilitate competency evaluations for staff that are pertinent to children of all ages. In addition, 9 of 13 or 69% of PECCs reported having access to resources needed to perform as a PECC, and only 4 of 13 or 31% reported having dedicated time for their PECC role and a written job description/responsibilities (Table 2). Data collected from nurse participants included years worked as a registered nurse, years worked as a registered nurse in the emergency department, approximate number of pediatric patients cared for per month, amount of pediatric education prior to this intervention, and whether the participant had ever worked in a pediatrics only role (Supplementary Appendix 4).

Feasibility measures. Feasibility was measured as (1) engagement and retention of ED educators and (2) the engagement and retention of nurse participants at each ED site. Additional data were collected on the time required of the educator for this work and rates of participants completing some or all interventions and/or evaluations. Educators engaged in biweekly check-ins, where feedback was solicited on implementation and opportunities for improvement. Educator postintervention surveys were collected to measure their activities and experiences (Table 3). Completion of individual educational activities by each learner was documented using a unique anonymous identifier. After each educational activity, learners reported their satisfaction, measured with a net promoter score for each activity, and had the opportunity to provide feedback on how to improve the intervention in free text. These site-specific data were provided to educators at each emergency department to track their learners' participation and support local implementation efforts. Overall site curriculum completion was defined as completion of pre/post telesimulations while educators remained engaged with central ImPACTS support via biweekly check-ins. Individual learner curriculum completion was defined as completion of the entire online curriculum with pre/post telesimulations as set forth in Figure 1, demographic/comfort survey completion, and pre/post knowledge survey completion.

Effectiveness measures. Satisfaction, comfort, and knowledge were measured through pre- and postintervention surveys. We used Likert scales to measure comfort with the demographic survey (Supplementary Appendix 4) and multiple-choice questions to measure knowledge (Supplementary Appendix 5). Responses were tracked via anonymous identifiers. Skills were measured using a 5-item critical action checklist of performance during the initial and final telesimulations (Supplementary Appendices 1 and 3).

Analyses. All data were manually entered into Qualtrics (Qualtrics, LLC, Provo, UT) and transferred into SPSS (v. 27.0; IBM Corp, Armonk, NY), with which all

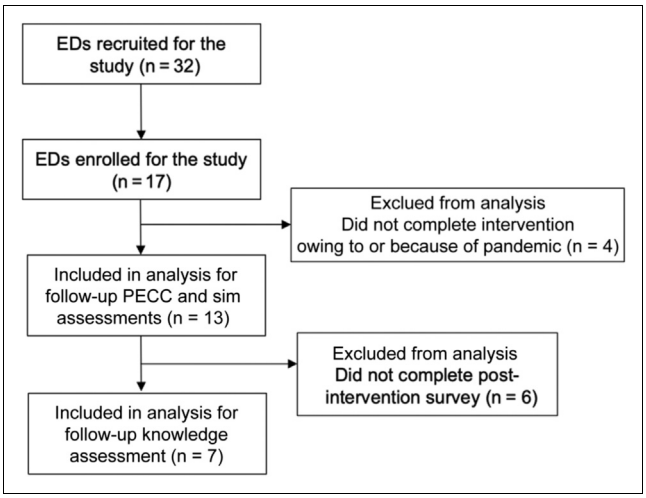

FIGURE 2

Study flow diagram: general emergency departments recruited. PECC, Pediatric Emergency Care Coordinator; ED, emergency department; sim, simulation.

statistical analyses were performed. Descriptive statistics (eg, frequencies, histograms, means, standard deviations, medians, interquartile ranges) were conducted for key demographics and variables. Additional bivariate analyses were conducted to examine differences in simulation performance and knowledge surveys pre- versus postintervention. These were conducted using Wilcoxon signed-rank tests. This study received institutional review board exemption by Riley Children's Hospital institutional review board.

Results

Thirty-two general ED sites were identified through recruitment efforts. Of these, 17 sites identified a nurse educator who connected with the ImPACTS project coordinator at least 1 time, and 13 sites completed the full intervention (Figure 2) via engaging in the pre and post telesimulation and maintaining central ImPACTS biweekly check-ins. Individuals from 7 of these sites completed the pre-post telesimulation and the pre-post knowledge surveys. These general emergency departments were geographically distributed across the United States and Canada. A total of 110 nurse learners started the curriculum, whereas 38 nurses (35%) completed the entire curriculum as defined by adherence to all elements of the entire curriculum including pre and post telesimulations and completing the pre and post knowledge survey with nurse learners per site (but did not complete week 10 educational activity). Twenty-two learners (20%) completed all the educational activities, including week 10.

NURSE EDUCATOR ACTIVITIES

All 13 general emergency departments were included in the analysis for follow-up nurse educator, with self-reported nurse educator demographics described in Table 2. The postintervention nurse educator survey was completed by 10 of the 13 nurse educators who completed the curriculum (Table 3). Nine out of 10 of those respondents reported that over the intervention period, they had delivered more pediatric education than before, with 100% reporting that the ImPACTS distance intervention did not detract from other nursing education. Sixty percent reported that 12 weeks of intervention was just enough, and the remainder reported that it was too long, with many PECCs verbally reporting to the central ImPACTS team that 12 weeks was too long for sustained engagement. Ninety percent or 9 of 10 also reported that they had access to resources needed to perform as a PECC as compared with 69% or 9 of 13 before intervention (Tables 2 and 3). Most PECCs would recommend the ImPACTS telesimulation nursing intervention (median of 9 on scale of 1-10, interquartile range [IQR] 8-10) (Table 3).

During biweekly check-ins, many nurse educators verbally reported to the program coordinator that it was unrealistic to limit this educational platform to nurses as typically, a provider such as an advanced practice provider or a physician would be present for all pediatric resuscitations from the beginning, regardless of how busy the emergency department might be. In addition, verbal feedback was consistently provided that 12 weeks was too long for asynchronous education on one specific topic. Finally, no sites filled out a subsequent WPRS as they had not solicited any changes during the educational intervention, so it was primarily used as a demographic measure.

LEARNER FEASIBILITY

Learner participation in weekly asynchronous learning activities waned over the course of the intervention from an initial 60% of participants completing weekly learning activities in weeks 2 and 3 to 20% of participants completing all activities in week 10.

LEARNER EFFECTIVENESS

Knowledge

Of the 110 learner nurse participants, 69 learner nurse participants (63%) filled out preintervention knowledge survey, and 38 learner nurse participants (35%) completed the post knowledge survey (Figure 3A). Intervention

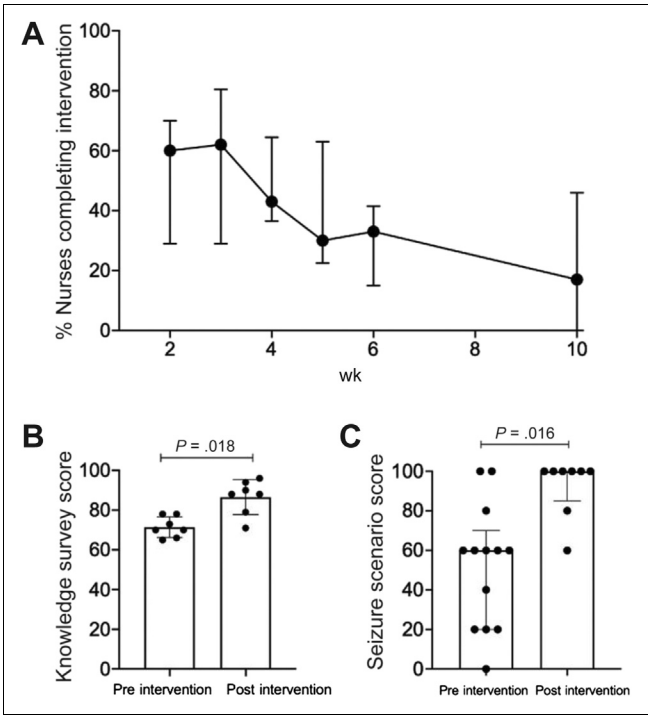

FIGURE 3

Implementation and pre vs post knowledge and simulation performance. (A) Percent of nurses completing the intervention over time implemented. (B) Knowledge survey scores pre and post intervention. (C) Telesimulation Seizure Scenario score pre and post intervention.

knowledge improved significantly ($P = .018$) from preintervention (median 70, IQR 66-78) to postintervention (median 88, IQR 79-94) (Figure 3B).

Seizure Telesimulation Skills

Thirteen sites completed the initial preintervention telesimulation, and 8 completed the postintervention telesimulation. Of these, telesimulation scenario critical actions team checklist performance demonstrated overall significant improvement ($P = .016$) in median score from 60 (IQR: 45-60) to 100 (IQR: 85-100) (Figure 3C, Table 4).

TABLE 4

Seizure telesimulation scenario team performance as emergency department level outcome

Critical actions	Preintervention		Postintervention	
	n = 13	%	*n* = 8	%
1. Verbalize airway response in first minute	7	54	8	100
2. Verbalize glucose check-in first 3 minutes	5	39	7	88
3. Verbalize correct dose of LORazepam IV/IO as first line agent	9	69	8	100
4. Verbalize correct dose of midazolam	3	23	6	75
5. Verbalize need for second line agent	10	77	8	100
TOTAL seizure score	Median = 60 IQR = 45-60		Median = 100 IQR = 85-100	
P value	0.016			

IQR, interquartile range; IV, intravenous; IO, interosseous.

Discussion

A distance educational curriculum on pediatric status epilepticus collaboratively developed and implemented by pediatric nurse educators with ImPACTS, targeting general emergency nurses during the COVID-19 pandemic, was feasible for general emergency nurse educators to implement. At the level of the individual nurse participant, a 12-week curriculum was not feasible for most participants to complete. Nurses who completed the curriculum had improvements in knowledge and skills, aligned with our study learning objectives. Pediatric nurse educators or PECCs reported that 85% had ongoing pediatric competencies in their general emergency departments before COVID-19; however, nurse educators reported that although pediatric training was available, it was currently stalled secondary to the pandemic. Optimistically, after our study, nurse educators reported that they would facilitate more pediatric educational activities for nurses and would recommend the telesimulation and distance learning. This supports that the curriculum was well regarded and generated more interest in pediatric education among participating PECCs (Table 3). Nurse educators also reported that the intervention did not detract from already available education (Table 3); thus, it can be a useful asynchronous and cost-effective intervention to augment traditional in-person courses, simulations, and didactics as we emerge from the pandemic. The a priori goal of at least 6 sites completing the intervention was met, with a total of 13 sites initially enrolled and 8 completing the final telesimulation. Ideally, we would see 100% completion of the entire curriculum,

but of the 110 nurses initially enrolled throughout the 13 sites, 38% completed most activities (except week 10), and 20% completed all interventions (including week 10). It is unclear why week 10 was not uniformly completed, perhaps secondary to it being the third "choose your own adventure" module during the 12-week intervention. Despite waning participation from 63% to 35% over the 12-week intervention, a statistically significant improvement was seen in postintervention knowledge of status epilepticus, as well as telesimulation critical action performance in those who completed these activities (Figure 3).

Limitations

We identified 5 major limitations to this work. First, recruitment and engagement of nurse educators and learners were likely confounded by provider burnout, financial strain, and provider turnover during the COVID-19 pandemic. Second, although our team engaged emergency nurse educators in the needs assessment, development, and implementation process of this work, the inter-team power dynamics may not have sufficiently empowered these educators, limiting their input. An example of these dynamics includes physician-nurse and academic-community interactions. This may have contributed to the low nurse participation, but this topic was not explicitly raised by nurse educators. Future efforts should work to enhance the authentic input from emergency nurse educators and nurses in every stage of the development, implementation, and iterative improvements. Third, this study involved nurse educators previously involved in ImPACTS work before the pandemic; thus, there was selection bias, and our findings may not be generalizable to "new" collaborations between general emergency departments and regional hubs. As PECCs were solicited from previous ImPACTS work, they would have already filled out the WPRS during previous ImPACTS collaborations, which likely explains why changes were not made and the score not filled out again at the conclusion of the intervention. Fourth, participants served as their own pre- and postintervention controls. Ideally, in future iterations, we can consider comparing (1) nurse performance at institutions with and without a PECC, (2) nurse performance without going through the intervention at a "control" site, or (3) nurse performance within a traditional simulation setting versus telesimulation curriculum to test the effectiveness of our designed curriculum/intervention. Finally, there was a low completion rate with a complex set of reasons. Not all participants completed the pre- and postintervention knowledge surveys, with a large decrease in participation with the postintervention knowledge survey. Waning participation in the study may be attributable to the intervention itself (length, topic, content) and/or COVID-19–related events (surges in other patients, reassignment of staff, staffing turnover). In response, we hope that future interventions will iteratively improve curriculum and specifically query frontline nurses regarding barriers to completing activities (in addition to the length and heavy clinical loads reported to the study team as contributing factors by PECCs during check-ins). Limiting this intervention to nurses was reported by participants as unrealistic; thus, the next iteration will include a physician or advanced practice provider to ensure fidelity. Technology failure and participant inexperience with video-conferencing and telesimulation also could have impacted the team; therefore, for future iterations, we will incorporate a prebrief on how to best use video-conferencing platforms and to delineate the needed technology. This study also did not evaluate actual clinical outcomes of real pediatric patients who presented in status epilepticus at the sites; however, it could be an outcome to evaluate in future studies.

Future Directions and Lessons Learned

Collaboration between pediatric nurse educators such as PECCs and regional academic medical center hubs on pediatric curriculum development and implementation could be generalizable to other emergency constructs. In addition, this type of collaboration could serve as a virtual community of practice for nurse educators and nurses to share educational resources with each other. Our outcomes of engagement of nurse educators in this project are well aligned with the existing pediatric readiness joint policy statement role of a nurse PECC—specifically, nurse PECC roles involving supported provider competency and education in the readiness for care of the acutely ill pediatric patient and collaboration with regional academic medical centers with ImPACTS biweekly check-ins.[18] We hope that this maturation of the relationships between nurse educators across general emergency departments and between nurse educators and regional ImPACTS hubs can serve as a model for continued collaboration in this group in the future. General emergency departments with nurse educators were targeted in this intervention as the NPRP joint policy recommends the presence of a PECC. We recognize that many general emergency departments nationally may not have a designated emergency nurse educator or PECC. Although our program may be of benefit to general emergency departments without educators and/or PECCs, we did not test it in that setting. We have reflected on the lessons learned from this project and have iteratively improved our intervention, and it is currently being implemented in another cohort. The next iteration involves a

shortened duration from 12 weeks to 5 weeks to improve adherence, added requirement for an interprofessional participation (physician or advanced practice provider), and a new virtual interactive telesimulation platform as an alternate and more realistic modality. In addition to guiding the development and implementation of ImPACTS work, we hope that this work will inspire others to consider collaborative distance learning curricula in general emergency departments.

Implications for Emergency Nurses

This collaborative method of development and implementation of an asynchronous distance learning curriculum can be used by emergency departments as a method for continuing nursing pediatrics education to improve knowledge and critical clinical action performance. As we emerge from the pandemic, we hope that emergency nurse educators will consider collaborative asynchronous education and telesimulation to augment their existing educational activities. Telesimulation has become more common as the COVID-19 pandemic has limited in-person educational opportunities, and this work demonstrates that it is a well-received and cost-effective instructional strategy that can be considered by educators after the pandemic and in low resource settings. In-person hands-on simulation will continue to be needed for tasks such as drawing up appropriate medication doses, placing an intravenous catheter, or finding equipment in the department. The educational materials used for this feasibility project are available as appendices, through the ImPACTS website, and via direct email contact with the study team.[17] It is important to note that this work was not intended for pediatric emergency departments or pediatric-specific settings with specialized pediatric emergency nurse specialists. The level of content for work targeting that group of nurses would likely need to be more advanced.

Conclusion

A longitudinal pediatric distance learning curriculum for general emergency nurses collaboratively developed and implemented by general emergency nurse educators with ImPACTS was feasible and resulted in improvements in nurses' knowledge and skills. The novel components of this work included the collaboration, telesimulation, and diverse asynchronous instructional strategies to provide alternative methods for continuing pediatric education for general emergency nurses during the COVID-19 pandemic. Future directions include shortening intervention time and broadening interprofessional scope.

Acknowledgments

We thank the nurse educators and the nurse participants for engaging in this project with Improving Pediatric Acute Care through Simulation. We acknowledge the contributions of members of the International Network for Simulation-based Pediatric Innovation, Research, and Education who have helped to shape this project and the International Pediatric Simulation Society for providing International Network for Simulation-based Pediatric Innovation, Research, and Education with space at their annual meetings for our research group. We acknowledge the Emergency Nurses Association Pediatric Update Section and Pediatric Committee members who provided substantive input and feedback to this work. We also acknowledge the contributions of members of the American College of Emergency Physicians Sim Box team: https://www.acepsim.com/about.

Author Disclosures

Conflicts of interest: none to report. This work was supposed by the Rbaby Foundation for overall project support to Yale University: https://www.rbabyfoundation.org as well as the Indiana University Health Values Grant VFE-358, Riley Children Foundation, Department of Pediatrics Grant, and the American College of Emergency Physicians pediatric section grant for Sim Box support: https://www.acep.org/how-we-serve/sections/sections-grants/.

Supplementary Data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jen.2022.09.001.

REFERENCES

1. Whitfill T, Auerbach M, Scherzer DJ, Shi J, Xiang H, Stanley RM. Emergency care for children in the United States: epidemiology and trends over time. *J Emerg Med*. 2018;55(3):423-434. https://doi.org/10.1016/j.jemermed.2018.04.019
2. Remick K, Gausche-Hill M, Joseph MM, et al. Pediatric readiness in the emergency department. *Pediatrics*. 2018;142(5):e20182459. https://doi.org/10.1542/peds.2018-2459
3. Gausche-Hill M, Ely M, Schmuhl P, et al. A national assessment of pediatric readiness of emergency departments. *JAMA Pediatr*. 2015;169(6):527-534. Published correction appears in *JAMA Pediatr*. 2015;169(8):791. https://doi.org/10.1001/jamapediatrics.2015.138

4. Ames SG, Davis BS, Marin JR, et al. Emergency department pediatric readiness and mortality in critically ill children. *Pediatrics*. 2019;144(3):e20190568. Published correction appears in *Pediatrics*. 2020;145(5):e20200542. https://doi.org/10.1542/peds.2019-0568
5. Ray KN, Olson LM, Edgerton EA, et al. Access to high pediatric-readiness emergency care in the United States. *J Pediatr*. 2018;194:225-232.e1. https://doi.org/10.1016/j.jpeds.2017.10.074
6. Emergency Nursing Pediatric Course (ENPC). ENA University. Published 2022. Accessed January 15, 2022. https://www.ena.org/enau/educational-offerings/enpc
7. AHA pediatric training for healthcare providers. American Heart Association. CPR & First Aid Emergency Cardiovascular Care. Published 2022. Accessed May 2, 2022. https://cpr.heart.org/en/cpr-courses-and-kits/healthcare-professional/pediatric
8. Free CE courses. ENA University: Published 2022. Accessed May 2, 2022. https://enau.ena.org/Public/Catalog/Main.aspx?Criteria=17&Option=76
9. Yang YT, Mason DJ. COVID-19's impact on nursing shortages, the rise of travel nurses, and price gouging. HealthAffairs website. Published January 28, 2022. Accessed May 2, 2022. https://www.healthaffairs.org/do/10.1377/forefront.20220125.695159/full/
10. Nie A, Su X, Zhang S, Guan W, Li J. Psychological impact of COVID-19 outbreak on frontline nurses: a cross-sectional survey study. *J Clin Nurs*. 2020;29(21-22):4217-4226. https://doi.org/10.1111/jocn.15454
11. Leaver CA, Stanley JM, Goodwin Veenema T. Impact of the COVID-19 pandemic on the future of nursing education. *Acad Med*. 2022;97(3S):S82-S89. https://doi.org/10.1097/ACM.0000000000004528
12. Chaiyachati BH, Agawu A, Zorc JJ, Balamuth F. Trends in pediatric emergency department utilization after institution of coronavirus disease-19 mandatory social distancing. *J Pediatr*. 2020;226:274-277.e1. https://doi.org/10.1016/j.jpeds.2020.07.048
13. Finkelstein Y, Maguire B, Zemek R, et al. Effect of the COVID-19 pandemic on patient volumes, acuity, and outcomes in pediatric emergency departments: a nationwide study. *Pediatr Emerg Care*. 2021;37(8):427-434. https://doi.org/10.1097/PEC.0000000000002484
14. Sokoloff WC, Krief WI, Giusto KA, et al. Pediatric emergency department utilization during the COVID-19 pandemic in New York City. *Am J Emerg Med*. 2021;45:100-104. https://doi.org/10.1016/j.ajem.2021.02.029
15. Raffaldi I, Castagno E, Fumi I, et al. Pediatric admissions to emergency departments of North-Western Italy during COVID-19 pandemic: a retrospective observational study. *Lancet Reg Health Eur*. 2021;5:100081. https://doi.org/10.1016/j.lanepe.2021.100081
16. Abulebda K, Whitfill T, Montgomery EE, et al. Improving pediatric readiness in general emergency departments: a prospective interventional study. *J Pediatr*. 2021;230:230-237.e1. https://doi.org/10.1016/j.jpeds.2020.10.040
17. Right care, right place, right time: improving pediatric acute care through collaboration. IMPACTS: Improving Pediatric Acute Care Through Simulation: A Simulation Collaborative. Published 2015. Accessed May 2, 2022. https://www.impactscollaborative.com/
18. American Academy of Pediatrics. Committee on Pediatric Emergency Medicine; American College of Emergency Physicians; Pediatric Committee; Emergency Nurses Association Pediatric Committee. Joint policy statement–guidelines for care of children in the emergency department. *Pediatrics*. 2009;124(4):1233-1243. https://doi.org/10.1542/peds.2009-1807
19. Abulebda K, Lutfi R, Whitfill T, et al. A collaborative in situ simulation-based pediatric readiness improvement program for community emergency departments. *Acad Emerg Med*. 2018;25(2):177-185. https://doi.org/10.1111/acem.13329
20. Auerbach M, Bhatnagar A, Abulebda K, et al. ImPACTS: a collaborative improvement intervention involving children's hospitals and general hospitals improves pediatric readiness. *Pediatrics*. 2020;146(1_MeetingAbstract):203-204. https://doi.org/10.1542/peds.146.1MA3.203
21. Abulebda K, Lutfi R, Petras EA, et al. Evaluation of a nurse pediatric emergency care coordinator-facilitated program on pediatric readiness and process of care in community emergency departments after collaboration with a pediatric academic medical center. *J Emerg Nurs*. 2021;47(1):167-180. https://doi.org/10.1016/j.jen.2020.06.006
22. Thomas PA, Kern DE, Hughes MT. *Chen BY*. Curriculum Development for Medical Education: A Six-Step Approach. 3rd ed. The Johns Hopkins University Press; 2016.
23. Scott SD, Albrecht L, Given LM, et al. Pediatric information seeking behaviour, information needs, and information preferences of health care professionals in general emergency departments: results from the translating emergency knowledge for kids (TREKK) needs assessment. *CJEM*. 2018;20(1):89-99. https://doi.org/10.1017/cem.2016.406
24. Montgomery EE, Thomas A, Abulebda K, et al. Development and implementation of a pediatric telesimulation intervention for nurses in community emergency departments. *J Emerg Nurs*. 2021;47(5):818-823.e1. https://doi.org/10.1016/j.jen.2021.01.013
25. Frankenberger WD, Pasmann A, Noll J, et al. Nursing research priorities in the pediatric emergency care applied research network (PECARN): reaching consensus through the Delphi method. *J Emerg Nurs*. 2019;45(6):614-621. https://doi.org/10.1016/j.jen.2019.07.014
26. Cheng A, Nadkarni VM, Mancini MB, et al. Resuscitation education science: educational strategies to improve outcomes from cardiac arrest: a scientific statement from the American Heart Association. *Circulation*. 2018;138(6):e82-e122. https://doi.org/10.1161/CIR.0000000000000583
27. Sanseau E, Lavoie M, Tay KY, et al. TeleSimBox: a perceived effective alternative for experiential learning for medical student education with social distancing requirements. *AEM Educ Train*. 2021;5(2):e10590. https://doi.org/10.1002/aet2.10590
28. McCoy CE, Sayegh J, Alrabah R, Yarris LM. Telesimulation: an innovative tool for health professions education. *AEM Educ Train*. 2017;1(2):132-136. https://doi.org/10.1002/aet2.10015
29. Ikeyama T, Shimizu N, Ohta K, Ohta K. Low-Cost and ready-to-go remote-facilitated simulation-based learning. *Simul Healthc*. 2012;7(1):35-39. https://doi.org/10.1097/SIH.0b013e31822eacae
30. Diaz MCG, Walsh BM. Telesimulation-based education during COVID-19. *Clin Teach*. 2021;18(2):121-125. https://doi.org/10.1111/tct.13273

31. Reece S, Johnson M, Simard K, et al. Use of virtually facilitated simulation to improve COVID-19 preparedness in rural and remote Canada. *Clin Simul Nurs*. 2021;57:3-13. https://doi.org/10.1016/j.ecns.2021.01.015
32. American College of Emergency Physicians. SimBox + Tele SimBox Leveraging Technology for Learning Anywhere. Published 2022. Accessed May 2, 2022. https://www.acepsim.com
33. Trau SP, Sterrett EC, Feinstein L, Tran L, Gallentine WB, Tchapyjnikov D. Institutional pediatric convulsive status epilepticus protocol decreases time to first and second line anti-seizure medication administration. *Seizure*. 2020;81:263-268. https://doi.org/10.1016/j.seizure.2020.08.011
34. Glauser T, Shinnar S, Gloss D, et al. Evidence-based guideline: treatment of convulsive status epilepticus in children and adults: report of the guideline committee of the American Epilepsy Society. *Epilepsy Curr*. 2016;16(1):48-61. https://doi.org/10.5698/1535-7597-16.1.48
35. INACSL Standards Committee. INACSL standards of best practice: Simulation debriefing. *Clin Simul Nurs*. 2016;12:S21-S25. https://doi.org/10.1016/j.ecns.2016.09.008
36. Eppich W, Cheng A. Promoting excellence and reflective learning in simulation (PEARLS): development and rationale for a blended approach to health care simulation debriefing. *Simul Healthc*. 2015;10(2):106-115. https://doi.org/10.1097/SIH.0000000000000072
37. Thomas A, Burns R, Sanseau E, Auerbach M. Tips for conducting telesimulation-based medical education. *Cureus*. 2021;13(1):e12479. https://doi.org/10.7759/cureus.12479
38. Vora S, Li J, Kou M, et al. ACEP SimBox: a pediatric simulation-based training innovation. *Ann Emerg Med*. 2021;78(3):346-354. https://doi.org/10.1016/j.annemergmed.2021.03.040
39. Erin Montgomery YouTube page. Accessed May 2, 2022. https://www.youtube.com/channel/UCg-Rzwty1Bty28Z5nY-ifeQ
40. Emergency Medical Services for Children, Innovation and Improvement Center, Texas Children's Hospital. Pediatric seizure 1: choose your own adventure module. SurveyMonkey. Published 2022. Accessed May 2, 2022. https://www.surveymonkey.com/r/SEIZURE1
41. Swaminathan A. REBEL core cast 9.0–pediatric status epilepticus. REBELEM. Published 2019. Accessed May 2, 2022. https://rebelem.com/rebel-core-cast-9-0-pediatric-status-epilepticus/
42. Tormey P. Seizures module. Don't Forget The Bubbles website. Published 2020. Accessed May 2, 2022. https://doi.org/10.31440/DFTB.27858
43. Emergency Medical Services for Children, Innovation and Improvement Center, Texas Children's Hospital. Pediatric seizure 2: choose your own adventure module. SurveyMonkey**.** Published 2022. Accessed May 2, 2022. https://www.surveymonkey.com/r/SEIZURE2
44. Emergency Medical Services for Children, Innovation and Improvement Center, Texas Children's Hospital. Pediatric seizure 3: choose your own adventure module. SurveyMonkey. Published 2022. Accessed May 2, 2022. https://www.surveymonkey.com/r/SEIZURE3