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Title: Repetitive Pediatric Simulation Resuscitation Training

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Abstract: Objective: To compare the effectiveness of repetitive pediatric simulation training (scenario-debriefing-scenario) to standard simulation training (scenario-debriefing).

Methods: Pediatric and Emergency Medicine residents prospectively participated in simulated pediatric resuscitation training sessions in an in-situ simulation room on a pediatric ward. Residents anonymously reported their knowledge, skills, and confidence after each simulation session. Four learners and two faculty preceptors (one pediatric emergency medicine attending and one pediatric emergency medicine fellow) participated in each session. Scenarios were performed on a high-fidelity simulator (SimBaby, Laerdal Medical, Stavanger, Norway) and video debriefing was used for all training sessions. Standard training (STN) was used in the initial 6 months of the study while repetitive pediatric simulation training (RPS) was used in the second 6 months of the study.

Results: 115 subjects completed simulation sessions during the study period. The RPS group reported higher overall debriefing quality and were more likely to report that the simulation session was an excellent method of teaching. The RPS group reported greater improvement in knowledge and skills than the STN group. Similar scores were reported for confidence, overall performance, stress levels, and realism of the simulator in both the STN and RPS groups.

Conclusion: Feedback is a key feature of effective medical simulation. The RPS design provides learners the opportunity to apply the knowledge and skills discussed during debriefing. This format led to improved self-reported knowledge, skills, and satisfaction with the simulator session.

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Introduction

The majority of pediatric residents will complete three years of pediatric training with little or no hands on resuscitation experience (1). In a survey at a tertiary care teaching hospital 44% of senior pediatric residents reported that they had never lead a code at the completion of clinical training. Resident errors were noted during 78% of intubation attempts and only 67% of intraosseous needle placements (2). Successful completion of the two-day Pediatric Advanced Life Support (PALS) course does not result in adequate skills of on-call residents (3). Decay in resuscitation knowledge and skills has been reported at one-year follow-up after the PALS course (4). Nationally the morbidity and mortality associated with Pediatric Cardiopulmonary Resuscitation has not changed significantly over the last three decades with mortality in the 70-85% range for non-ICU resuscitations (5-7).

Trainees are experiencing diminishing exposure to high acuity “code” situations during residency because of work hour restrictions, increasing sub-specialization, and an increased emphasis on primary care. Quality resuscitation education necessitates novel modalities to teach and test pediatric resuscitation in the face of providers not having these experiences during their routine training experiences. Educational sessions that use simulated patients to provide residents experiences with critical illness have resulted in improved confidence and performance (8). Practice with medical simulators boosts skills and is superior to resuscitation course teaching. Simulation has been demonstrated to be equal to real patient exposure to learn highly complex procedures (9).

The traditional format for simulation sessions involves trainees managing a case and subsequently debriefing with a facilitator about their performance. Debriefing and reviewing the videotape of their performance after the case allows for immediate feedback. The errors noted during review are just as valuable to learning as successes, something that is not desirable in real life clinical experiences. Watching your own performance during debriefing raises awareness of aspects of performance largely ignored in other educational modalities. This increases the chance that the learner will perform better when called upon in real life.

While debriefing has proven effective not much is known about the effect of immediate post-debriefing practice on learning. We propose that a chance to apply the feedback discussed in debriefing and correct deficits during an immediate second simulation experience will lead to improved training compared to the standard format. This immediate opportunity to apply knowledge and skills is necessary because the resident is unlikely to have the opportunity to apply this knowledge in the clinical arena.

Methods

Data was collected from pediatric and emergency medicine residents participating in high-fidelity (SimBaby, Laerdal Medical, Stavanger, Norway) simulated pediatric resuscitations during their in-patient rotations at Bellevue Hospital Center during the period from April 2008 to April 2009. All house-staff were PALS certified prior to enrollment. All learners went through a simulator orientation prior to any training to gain familiarity with the equipment. Simulated codes occurred in an in-situ simulation room on the Pediatric floor on a bi-weekly basis. Four learners participated in each session lead by two faculty preceptors (Pediatric Emergency Medicine Attending and Fellow). The content for all sessions was developed to reinforce the PALS algorithms. Debriefing involved an open discussion of the performance, faculty feedback, and video review to reinforce knowledge and skills related to the case. Neither the study investigator nor the subjects were blinded to group assignment.

For the first six-months of the study debriefing was conducted using the Standard format. This format involves the learner participating in a simulation case followed by video debriefing and feedback. The facilitator and participants review key points related to pre-defined goals and objectives for the simulation session. This is done through discussion and review of the video recording of the case.

For the second six-months of the study debriefing was conducted using the Repetitive debriefing format. This format involved the learner participating in a 10-minute simulation case followed by video debriefing and feedback. However, the RePedSim format provided the trainees an opportunity to apply the learning points discussed during debriefing by participating in a second 10-minute simulation similar in content to the first case (Figure 1).

At the end of each simulation session participants completed the data collection instrument. The data collection instrument collected demographic information such as training year, prior resuscitation training, prior resuscitation experience, and the time since last PALS training. Participants self reported their knowledge, skills, and attitudes for the session. Data was collected using 5 point likert scales ranging from 1=poor/strongly disagree to 3=fair/neutral to 5=excellent/strongly agree. Demographic variables were compared using chi-squared and ordinal data was compared using a Mann-Whitney U test.

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Figure 1. Training groups

Standard Session (50 minutes) 1. Anaphylaxis case (20 minutes) A. Poor recognition of anaphylaxis B. Administered epinephrine SC instead of IM 2. Video debrief/feedback- discuss case deficits A/B (30 minutes)
Repetitive Session (50 minutes): 1. Anaphylaxis case (10 minutes) A. Poor recognition of anaphylaxis B. Administered epinephrine SC instead of IM 2. Video debrief/feedback- discuss case deficits A/B (30 minutes) 3. Application knowledge and skills in another anaphylaxis case (10 minutes)

Results

The trainees enrolled in the first and second phase of this study were similar in distribution of post-graduate year (PGY) and subspecialty. The traditional group was trained during the first portion of the academic year and therefore had less real life and simulation code experiences (Table 1).

Table 1. Trainee Variables

	Traditional N=74	RePedSim N=77
Peds PGY1	25	23
Peds PGY2	25	23
Peds PGY3	10	9
EM PGY2	14	12
# prior real codes(mean)	2	3
# prior sim codes (mean)	3	4

No difference was noted in the providers' overall performance (mode=3/fair) on the simulator or their self reported levels of stress (mode=2/slight stress), and the perceived realism (mode=4/very realistic) of the simulator between the two groups. The Repetitive group more frequently reported strong agreement with

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the statement that the simulation experience improved their knowledge and skills compared to the traditional group. Both groups reported only slight agreement with the statement that the simulation experience improved their confidence. The Repetitive group reported that the simulation session was of excellent quality and that simulation was an excellent teaching method while the traditional training group reported these items as fair (Table 2).

Table 2. Educational experience

	Traditional	RePedSim	
Improved knowledge	3 (neutral)	5 (strongly agree)	P=0.005
Improved skills	3 (neutral)	5 (strongly agree)	P=0.022
Improved confidence	4 (slightly agree)	4 (slightly agree)	P=0.400
Debriefing quality	3 (fair)	5 (excellent)	P=0.05
Simulation as a teaching method	3 (fair)	5 (excellent)	P<0.005

Discussion

The more opportunities that a provider has to practice resuscitation scenarios the better prepared they will be for difficult cases with real patients. Practice with medical simulators boosts skills and is superior to classroom resuscitation course teaching. After participating in simulation exercises the majority of students and educators rate their experiences as excellent and feel that simulation should be required in training (9).

One of the most effective features of simulation is the opportunity for “hands-on” practice, but in the standard format of simulation the trainee is not given a chance to apply their newly acquired knowledge and skills after debriefing. The provider is unlikely to encounter a patient requiring this subset of knowledge and skills for a protracted period of time. The opportunity to immediately apply these newly acquired skills to a simulated patient could lead to improved retention if and when these skills are needed for a real patient encounter. In our cohort as in other published data students and educators consistently accept simulation and are pleased with it as an effective educational tool.

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This study is limited in that the experience of residents in resuscitation is highly variable. Different medical schools provide an array of experiences in pediatrics. Residents also come from a wide variety of backgrounds preceding medical school: some may be well versed in pediatric resuscitation (ex: they were an EMT for years) while others may have never been exposed to a critically ill child.

Conclusion

Feedback is a key feature of effective medical simulation. The Repetitive design in this study provided learners the opportunity to apply the knowledge and skills discussed during debriefing. This format may lead to improved self-reported knowledge, skills, and satisfaction with the simulator session. Future studies should address if this debriefing format improves retention and translates to improved performance in providers' clinical performance during resuscitations.

References

1. Ziv A, Ben-David S, Ziv M. Simulation based medical education: An opportunity to learn from errors. *Med Teach*. 2005 May;27(3):193-9.
2. White JR, Shugerman R, Brownlee C, Quan L. Performance of advanced resuscitation skills by pediatric housestaff. *Arch Pediatr Adolesc Med*. 1998 Dec;152(12):1232-5.
3. Gemke RJ, Weeteling B, van Elburg RM. Resuscitation competencies in paediatric specialist registrars. *Postgrad Med J*. 2007 Apr;83(978):265-7.
4. Spina L., Heon D., Mojica M. Retention by residents of PALS knowledge and skills. PAS Annual Meeting May 2006.
5. Lopez-Herce J, Garcia C, Dominguez P, Carrillo A, Rodriguez-Nunez A, Calvo C, et al. Characteristics and outcome of cardiorespiratory arrest in children. *Resuscitation*. 2004 Dec;63(3):311-20.
6. Nadkarni VM, Larkin GL, Peberdy MA, Carey SM, Kaye W, Mancini ME, et al. First documented rhythm and clinical outcome from in-hospital cardiac arrest among children and adults. *JAMA*. 2006 Jan 4;295(1):50-7.
7. Reis AG, Nadkarni V, Perondi MB, Grisi S, Berg RA. A prospective investigation into the epidemiology of in-hospital pediatric cardiopulmonary resuscitation using the international utstein reporting style. *Pediatrics*. 2002 Feb;109(2):200-9.
8. Nadel FM, Lavelle JM, Fein JA, et al. Teaching resuscitation to pediatric residents: the effects of an intervention. *Arch Ped Adolesc Med* 2000; 154 (10) 1049-1054).
9. Issenberg SB, McGaghie WC, Petrusa ER, Lee Gordon D, Scalese RJ. Features and uses of high-fidelity medical simulations that lead to effective learning: A BEME systematic review. *Med Teach*. 2005 Jan;27(1):10-28

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