Pediatric Fluid Bolus Calculation Skill Simulation: A Multi-Encounter Approach

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Abstract

Introduction

"Medical knowledge learned by trainees is often quickly forgotten."[1] Improving retention of new medical knowledge and skills in undergraduate medical students is central to their successful preparation for clerkships and residencies. In BLS training "many skills deteriorate rapidly over the course of the first 90 days."[2]

Spaced education has been shown to improve medical knowledge for 3rd year medical students during rotations.[1] Short-term learning measured by a post-test administered closely following a training encounter is not effective at achieving long-term skill retention and mastery. To achieve long-term skill retention a new approach to clinical education is needed.

Purpose/Hypothesis

The purpose of the research is to investigate medical knowledge and skill retention in simulation training. By spacing out repeated simulation encounters is it possible to improve student retention of medical knowledge and skills in undergraduate medical students?

RQ: Does spaced education improve retention of fluid bolus calculation skills in undergraduate pediatric simulation encounters?
H0: Spaced education does not change retention of fluid bolus calculation skills in undergraduate pediatric simulation encounters.
HA: Spaced education changes retention of fluid bolus calculation skills in undergraduate pediatric simulation encounters.

Methods

Two cohorts of medical students, Class of 2017 (N=153) and Class of 2018 (N=154), who were either in their late second year or early third year of medical education were created. Both groups participated in the same simulation case with the Class of 2018 having the case repeated 180 days later. The case presents a 5-year-old male who has just arrived to the pediatric floor with a 3-day history of vomiting and diarrhea and is now showing signs of dehydration. (NLN/Laerdal Case)

The Class of 2017 received didactic training during the MS2 year and a pre-reading for the early 3rd year simulation encounter. The Class of 2018 received didactic training during the MS2 year and participated in the simulation encounter; approximately 180 days later this cohort then received a pre-reading and a repeat of the same simulation encounter at the beginning of their 3rd year (SIM Month for Class of 2018). One of the objectives is to correctly calculate fluid bolus volume which will effectively treat the patient. For all encounters students completed a pre- and post-assessment asking "What is the appropriate initial fluid bolus in a child that weighs 30kg?" (SIM Month 2018 pt. weight 40kg). The assessment was based on the student's knowledge of proper fluid bolus calculations.

Assessment and Results

Assessment

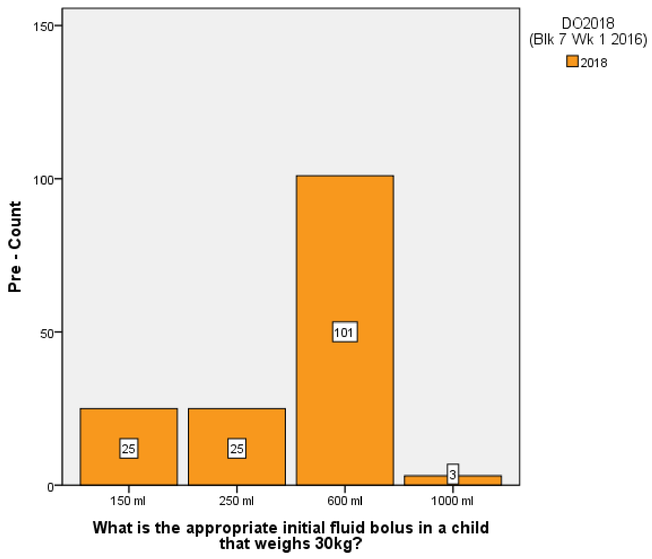
Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of What is the appropriate initial fluid bolus in a child that weighs 40kg? is the same across categories of DO2017 or DO2018.	Independent-Samples Mann-Whitney U Test	.387	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

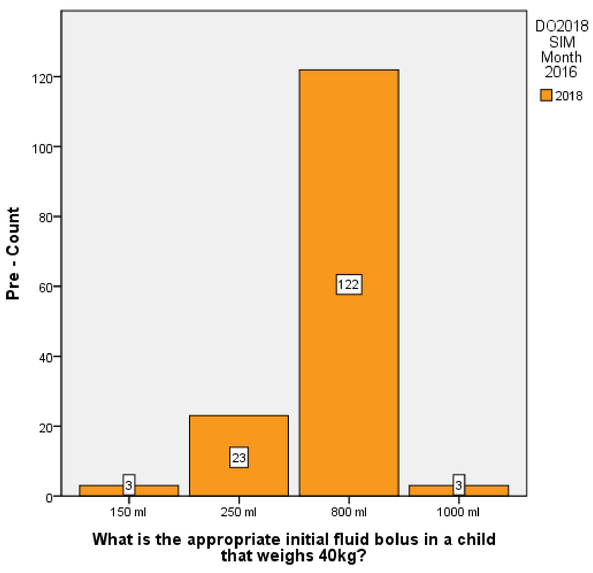
In order to verify the simulation encounter (independent of the class pre-knowledge of fluid bolus calculation) is consistent in changing SIM Month Post knowledge between the DO 2017 and 2018 cohorts we ran a Mann-Whitney U Test. The simulation encounter was effective at achieving uniform levels of post encounter knowledge.

Pre-Assessment fluid bolus calculation responses.



DO 2018 (N=154) B7
65.6% Correct

To positively effect future patient outcomes the student must be able to accurately recall the correct fluid bolus calculation prior to being challenged with the next encounter. 180 days later DO Class of 2018 show a 15.2% improvement.



DO 2018 (N=151) Sim Month
80.8% Correct
15.2% Improvement

Discussion and Conclusion

Discussion

Assessment of retention of medical knowledge in simulated clinical settings is foundational to establishing the efficacy of simulation training in contrast to traditional didactic approaches. Our results lend support that student retain clinical knowledge in basic pediatric fluid calculation better with repeated and spaced education. Continuing this research will allow for better evaluation of the best approach to successfully integrate simulation training with more traditional education modalities. Further study is needed of the frequency of encounter and time between encounters which can achieve the best retention outcomes. Moving forward we are collecting Class of 2019 data in July to evaluate between cohorts.

Conclusion

Spaced education approach in simulation improves students' ability to retain and apply correct medical knowledge and practices when confronted with similar circumstances. Improved retention of medical knowledge and the ability to apply it directly influences outcomes in patient care.

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Simulator and Scenario

- Laerdal Sim Jr. Pediatric Simulator
- Simulation in Nursing Education – Pediatric Scenario, Dehydration Vomiting and Diarrhea – Complex Case, National League for Nursing, Product Number SMS3970 (Version 7)

References

1. Kerfoot BP, DeWolf WC, Masser BA, Church PA, Federman DD. Spaced education improves the retention of clinical knowledge by medical students: A randomised controlled trial. *Medical Education*. 2007;41(1):23–31. doi:10.1111/j.1365-2929.2006.02644.x.
2. Anderson GS, Gaetz M, Masse J. First aid skill retention of first responders within the workplace. 2011;19. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3044091/. Accessed January 19, 2017.
3. Eppich WJ, Adler MD, McGaghie WC. Emergency and critical care pediatrics: use of medical simulation for training in acute pediatric emergencies. Curr Opin Pediatr. 2006;18(3):266-271.
4. Harden RM. Trends and the future of postgraduate medical education. Emerg Med J 2006; 23: 798–802.
5. Adler MD, Trainor JL, Siddall VJ, McGaghie WC. Development and evaluation of high-fidelity simulation case scenarios for pediatric resident education. Ambul Pediatr 2007; 7: 182–186.
6. Fanning RM, Gaba DM. The role of debriefing in simulation-based learning. Simul Healthc 2007; 2: 115–125.

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