Simulation as a Tool to Improve the Effectiveness of Diabetes Sick Day Education

Catherine Fox, MS, RD, CDCES; Hailee Delsart, MD; Gary Geis, MD; Emily Smith, BS, CCRP; Kathleen E. Walsh, MD, MS; Patrick Brady, MD, MSc; Eric S. Kirkendall, MD, MBI; and Sarah Corathers, MD

Introduction

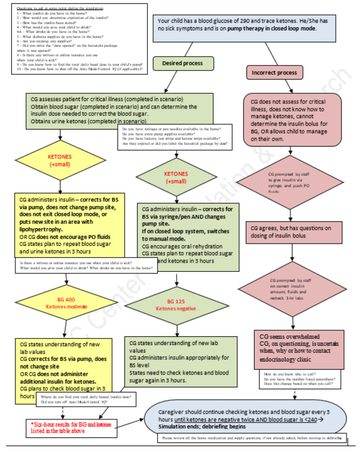
- Type 1 diabetes (T1D), like other chronic conditions, is managed largely at home.
- Sick days and ketone management are at high risk for serious error, as these happen infrequently, and management is complex.
- Healthcare simulation is an effective tool for allowing clinicians to practice treating uncommon cases, but there is limited research regarding the use of simulation as a tool for teaching patients with diabetes, particularly pediatric patients.
- The aim of this project was to design and test scenarios for sick day management simulation training for caregivers of children with T1D.

Research Hypothesis

Use of simulation-based training can increase caregiver proficiency with sick day management.

Methods

- Five common sick day simulation scenarios were created.
- Each scenario (example to the right) included alternate pathways that could be utilized based on the caregiver's responses.
- We recruited 12 parents of children with T1D or young adults with T1D from our clinic and used block randomization to assign three scenarios (see below).
- Simulations were performed via telehealth and subjects were encouraged to utilize any resources that they had available at home.
- Subjects were introduced to the concept of psychological safety, given an introductory scenario (non-ketotic hyperglycemia) and two challenging sick day/ ketosis scenarios.
- Raters scored participant responses to sick day management prompts, as desired, less desired, or incorrect.
- The team co-debriefed with participants after each scenario.



Block Randomization Schematic

	Set 1	Set 2	Set 3	Set 4	Set 5	Set 6
First Scenario	1	1	1	1	1	1
Second Scenario	2	3	4	5	2	4
Third Scenario	3	5	3	4	5	2

Results

Demographics

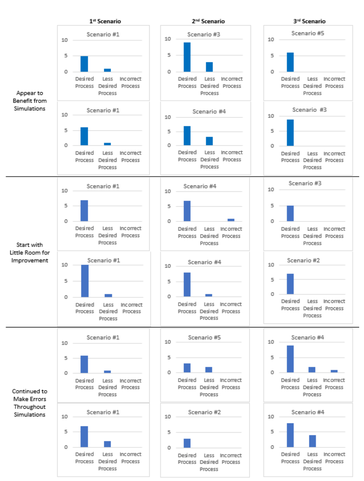
- Participants were mostly parents of children with T1D, and slightly over half (58%) were on private insurance. Participants self-identified as white (67%), black/African American (17%), Hispanic (8%) or multiple races (8%). Nearly all were female (92%) and most (83%) had some college or a college degree.

Errors Detected in Simulation

- The most common errors were not understanding how to calculate ketone dosing, not knowing the meter or CGM range, and not suspecting a pump site malfunction when ketones were present.

Error type	# with error (%)
Dosing error	3 (25%)
Tech errors	2 (17%)
Ketone error	5 (42%)
Treatment error	0

	1st Scenario	2nd Scenario	3rd Scenario
Desired Process	77	75	94
Less Desired Process	14	16	10
Incorrect Process	1	3	1

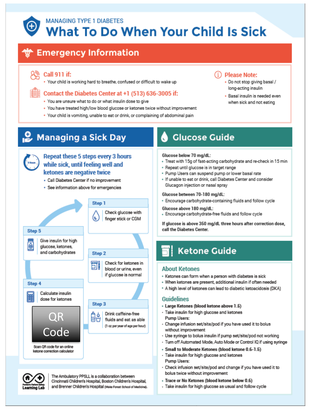


Improvements in Simulation Performance

- Participants overall trended towards improvement in the final simulation.
- Eight out of the 12 participants made no errors during the final scenario.
- Some made few errors initially which left little room for improvement.
- Another group continued to make significant errors despite receiving education during the intervention.

Creation of Support Tools

- During the simulations, families utilized existing sick day guidelines.
- Our group also created a tool that is both on paper and on a website with a ketone calculator that can be reached through a QR code (under development)
- Participants endorse benefit of simple instructions, available for "just in time" reference in both paper and digital formats.



Discussion

Families need education that makes sick day management familiar.

- All participants received ketone and sick day guideline education as standard care, but only one completed the first sick day scenario without any errors.
- Simulation provides an opportunity to identify knowledge deficits and experience the consequences of incorrect choices without causing harm.
- Simulation allows quick and repeated practice of the desired steps of sick day management to facilitate retention. Each scenario took 5 – 20 minutes.
- However, simulation or other sick day education must be conducted regularly to ensure that the skills remain available when they are needed.

A crucial piece of any simulation session is establishing psychological safety.

- Psychological safety sets the expectation that simulation is not a test and that mistakes are a normal and encouraged as part of the learning process. This gives families permission to fully participate in the simulation, ask questions, and learn from mistakes.
- During debriefings, we asked participants about their level of comfort with the process, and they reported feeling some stress because the simulation felt real but denied feeling uncomfortable with the simulation process.

Simulation is not an appropriate strategy for all patients and should be used as one option among a variety of educational tools.

- Some participants adequately understood the education they received at diagnosis and made few errors on any of the simulations.
- There were participants who continued to make significant errors despite undergoing education at diagnosis and practice through simulation.
- This suggests that additional intervention is needed to distill sick day guidance to a level that is easily understood and utilized by those who do not benefit from simulation.
- We also created a simplified set of written guidelines as an alternate way to support caregivers and plan to test its effectiveness further.

Conclusions

- Simulation is an effective tool to help reduce errors during sick day management but is not sufficient to eliminate errors for all families.
- Additional resources are needed to facilitate timely decision-making.

Acknowledgements

Related research: Kirkendall, ES, Brady PW, Corathers SC, Ruddy RM, Fox C, Nelson H, Wetterneck TB, Rodgers I, Walsh KE. Safer Type 1 Diabetes Care at Home: SEIPS Based Process mapping with Parents and Clinicians. *Ped Qual and Safety.* In Press.

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