Posters

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Simulation Based Clinical Systems Testing of a Pediatric ED to Improve Staff and Process Readiness for Pediatric Hypoglycemia

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Introduction

- Hypoglycemia is the most common metabolic disorder in children in pediatric emergency department (ED) settings
- Children may present with nonspecific symptoms or asymptomatically, making identification and treatment challenging
- There is evidence in the adult literature of wide variability in the treatment of hypoglycemia
- No current standardized approach to treatment of hypoglycemia (other than associated with diabetes mellitus) at Children's Mercy Hospital (CMH) leading to gaps in identification and treatment
- Delayed recognition and treatment can lead to poor patient outcomes including seizures, coma, and death
- Simulation-based clinical systems tests (SbCSTs) detect gaps/latent safety threats (LSTs) in system design
- 2 primary questions:
  - Can SbCSTs identify gaps/LSTs and recommendations for improvement for hypoglycemia care?
  - Would providers consider SbCSTs an acceptable way to test and train?

Methods

- The study took place in the CMH ED and was approved by the IRB as nonhuman subject research
- SbCSTs were conducted with staff responding to a 5-month old with hypoglycemia and used "tipping-point"(s) in care to emulate challenges
- A Gamaurd mannequin and tablet-based monitor (SimMon) were used in the simulations
- Short scripted debriefs reviewed guidelines, staff input, and then staff repeated simulations
- 2 project staff observed and collected data on a standardized reporting form including gaps/LSTs identified and staff suggestions for improvement/mitigation and used an inductive approach to categorize the findings.
- Providers evaluated this process using a web-based survey for acceptability and utility using a 5-point Likert scale

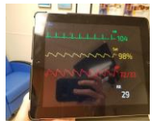

Fig1: tablet based monitor

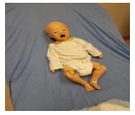

Fig2: Gamaurd mannequin

Results

- 12 SbCSTs were conducted with a total of 22 staff with 13 (59%) completing an evaluation (7-MDs, 4-RNs, 2-APRNs)
- Staff identified 50 LSTs. Each LST was categorized for cause as follows: 14 (28%) glucose gel location/administration concern, 12 (24%) need for a better job aid, 10 (20%) were related to dextrose dosing errors, 7 (14%) POC glucose recheck timing, and 7 (14%) inappropriate treatment
- Provider assessment of the process: An acceptable process: (strongly disagree, SD to strongly agree, SA): Worth the time it took: 85% SA, 15% somewhat agreed (SWA). Improved staff readiness: 85 % SA, 15% SWA. An effective way to test/provide solutions: 85% SA,15% SWA. The debrief allowed staff to share ideas: 85% SA, 15% SWA.

LST category	Frequency	LST description	Resolution
IV Dextrose Dosing error	10/12 (83%)	Participants did not know dosing and/or concentrations of IV dextrose. Use of CMH card alone did not lead to correct dosing. Some patients received too much glucose, others too little which can lead to over/undertreatment respectively with associated complications (I.e. seizures, unnecessary admission)	Discussed use of standardized solution (I.e. D10 0.5-1gm/kg) to avoid calculation errors and reduce cognitive load
POC glucose recheck timing error	5/12 (42%)	Large variability in timing of POC glucose checks following treatment (ideal is 15-30 minutes, some providers checked within 5 minutes, others at 1 hour) which could lead to over/undertreatment or deterioration of patient	Discussed ideal timing of POC glucose rechecks
PO glucose gel location concern	7/12 (58%)	Participants did not know where to find PO glucose gel delaying care	Glucose gel now available with all glucometers in Adele Hall ED
PO glucose gel administration concern	7/12 (58%)	Participants did not know that glucose gel has buccal absorption, removing one possible temporizing option	Discussed with participants routes of administration of glucose gel
Unfamiliar with alternative treatments (no plan B)	6/12 (50%)	May lead to no treatment or delay of care due to only 1 option (IV dextrose) in many participants' minds if IV access delayed or unable to obtain	Provider education
No POC glucose repeated	2/12 (16%)	No check for effectiveness of therapy could lead to patient deterioration, complications including seizures	Provider education
Only PO therapy given	1/12 (8%)	No parenteral therapy led to inadequate therapy for patient and subsequent complications	Provider education
Job aid/Checklist	12/12 (100%)	CMH card dosing caused confusion for participants who were unfamiliar with dosing of dextrose in grams rather than in volume	Changes to CMH Card?

Table 1: LST categories, frequency, description, and resolution. Question marks identify potential future changes.

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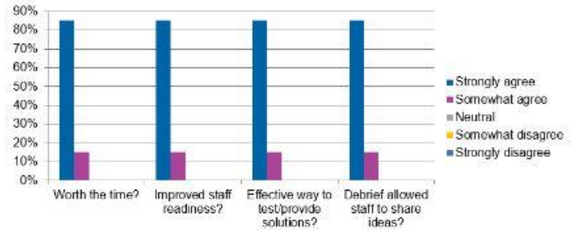

Figure 3: Provider assessment of the process evaluation results on a 5 point Likert scale

Discussion

This study demonstrated that SbCST methods are acceptable for use in a children's hospital ED for hypoglycemia testing and training. Participant evaluations demonstrate a high regard for this method. The process detected many LSTs with a formal FMEA process still in progress. However, some changes, such as the increased availability of PO glucose gel in the CMH ED and increased provider education about many LSTs have been implemented. Further changes, such as the recommended changes to the CMH job aid, are being discussed.

Conclusion

In situ simulation of provider response to a pediatric patient with hypoglycemia not associated with diabetes mellitus allowed us to identify and address problems not previously identified by providers and led to changes in the ED workspace and increased provider awareness of the gaps/LSTs surrounding this condition. Further changes will be implemented once the FMEA process is concluded.

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