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

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Hypoglycemia is the most common metabolic disorder in children in pediatric emergency department (ED) settings. Children may present with nonspecific symptoms or asymptptomatically, making identification and treatment challenging. There is evidence in the adult literature of wide variability in the treatment of hypoglycemia, especially in the context of diabetes mellitus. Children's Mercy Hospital (CMH) is leading to gaps in identification and treatment of hypoglycemia, leading to gaps in identification and treatment of hypoglycemia. Delayed recognition and treatment can lead to poor patient outcomes including seizures, coma, and death.

Simulation-based clinical systems testing (SbCSTs) detect gaps/lateness safety threats (LSTs) in system design and implementation. The study took place in the CMH ED and was approved by the IRB as a nonhuman subject research project. SbCSTs were conducted with staff responding to a 5-month-old with hypoglycemia and using “topping-point” care in a simulated examination setting. A Gamaurd mannequin and tablet-based monitor (SimMon) were used in the simulations.

Simulation-based systems testing (SbCSTs) detected 50 LSTs. Each LST was categorized for cause as follows: 14 (28%) glucose gel location/administration concern, 12 (24%) needing a better job aid, 10 (20%) were related to dextrose dosing errors, 7 (14%) PO glucose gel recheck timing, and 7 (14%) inappropriate treatment.

Results

- **Table 1: LST Categories, Frequency, Description, and Resolution**

<table>
<thead>
<tr>
<th>LST Category</th>
<th>Frequency</th>
<th>Description</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose gel location/administration concern</td>
<td>14/50 (28%)</td>
<td>Inability to locate/reach glucose gel at correct dose</td>
<td>Discussed use of standardized location/administration</td>
</tr>
<tr>
<td>Glucose gel recheck timing</td>
<td>7/50 (14%)</td>
<td>Dextrose gel recheck timing problem</td>
<td>Discussed goal timing of PO glucose recheck</td>
</tr>
<tr>
<td>Job aids/generics available in ED</td>
<td>7/50 (14%)</td>
<td>Gastrointestinal (GI) issues relating to availability of PO glucose gel in ED</td>
<td>Recommended gi available in ED for GI issues</td>
</tr>
<tr>
<td>Provider Education</td>
<td>12/50 (24%)</td>
<td>Provider education related to glucose gel administration</td>
<td>Discussed with participants needs of administration of glucose gel</td>
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Discussion

This study demonstrated that SbCST methods are acceptable for use in a children’s hospital ED for hypoglycemia testing and training. Participants evaluated methods to 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 pediatric 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 completed.

References