Combining Lean Initiatives with High-fidelity Simulation

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Hospital based high-fidelity simulation program

• In-situ (vs laboratory/classroom)
• Useful for evaluation of physical settings & human factors - field usability testing
• Used to orient staff to new teams & clinical departments
Context

– Site redevelopment - construction of new PED
– Corporation’s quality specialists all obtaining green belt lean/6sigma certification
– MOH lean process improvement / P4R initiatives
– Previous work with simulation
  • Product evaluation
  • Equipment - field usability testing
ED room design

- Created mock-up rooms from blue prints
- Two 30 minute scenarios of respiratory arrest
  - infant / child - both included standardized family member
- Project Leads
  - Trained in Lean methodology
  - Present during simulation to document work flow & generate field notes
  - Digital video recordings for validation
### 5S/6S - a litmus test for lean

<table>
<thead>
<tr>
<th>Sort</th>
<th>useful from unnecessary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set in order (straighten)</td>
<td>everything in its place, visual cues</td>
</tr>
<tr>
<td>Sweep/Shine</td>
<td>“spring cleaning”</td>
</tr>
<tr>
<td>Standardize</td>
<td>make cleaning, inspection, safety part of the routine job</td>
</tr>
<tr>
<td>Sustain</td>
<td>establish an environment including audits/cues to ensure 6S sticks</td>
</tr>
<tr>
<td>Safety</td>
<td>proactively look for potential safety issues, make the environment safe</td>
</tr>
</tbody>
</table>
Spaghetti mapping
Debriefing

• Input from multidisciplinary team
  – capital development, ED management, ED RNs, ED MDs, RTs

• Focus on participant observation of:
  – Room design
  – Patient, equipment, staff flow
    • Example: “When reaching for the thermometer I noticed that the IV pole was in the way” RN
Mapping / Debriefing points

• Original location of parent chair - obstructed access to equipment
• Patient monitor arm - inadequate ROM, not used to full potential
• Suction canisters difficult to reach
• Clock difficult to see - needs to be higher
• Sink location prevented bringing Broselow cart into room
Debriefing

• Qualitative analysis of spaghetti maps
• Chairs, carts monitors adjusted to optimized sight lines & efficient work flow
• Outlets, equipment mounts, switches sorted & grouped:
  – to match use by disciplines
  – to improve ease of access
Discussion

• 5s/6s Lean events require in-situ observations
• May be applied to unit design
• Sim combined with Lean:
  – Safe & ethical
  – Allows staff & leadership to identify the value-added of room elements/design
  – Innovative, non-medical application to embedded scenarios
Lean aided value stream mapping
VSM basic steps

• Pick a starting point and follow the entire process - eg. “staple yourself to a patient”
• Identify each process & times associated with processes
• Identify wait times
• Essential to capture times
• Leave process details to process mapping
• VSM should capture what typically happens ~80% of the time
Methods

- Creation of extended simulation scenario
- Classroom VSM exercise to create map
- In-situ simulation VSM with evaluation
Extended Simulation Scenario

- A stable long-term high-fidelity sim
- 7 yo with DKA
- Lasts 8 hours + in duration
- Previously tested in pilot project
PEDi-PIP Value Stream Map

- Patient Received: 2 minutes
- Radio: 3-5 minutes
- Registration: 4-5 minutes
- ERIP Initial Assessment: 5 minutes
- RN Treatment: 5 minutes
- Health Assessment (SW, OLGA): 10 minutes
- Physician Treatment: 15 minutes
- All Health Treatment: 30 minutes
- Discharge Decision: 1-30 minutes
- Pre-discharge prep & Education: 15 minutes
- Discharge: 0 minutes
- Room clean & prepared: 10-30 minutes

Average time to bed: 80.8 minutes
Results

- 20+ process steps were identified in classroom VSM
- estimated process times 2 - 90 min
- wait times of 0-150 min
- Examples of process steps:
  - patient triage, registration, RN primary assessment, MD assessment, order writing, processing of labs.
Results

- The existence of each process step was confirmed in the SIM data set.
- Observed times for each process fell within the estimated ranges of the classroom VSM.
- Measured wait times were consistently below estimated wait times.
- Total simulation time from patient presentation until admission was 210 minutes.
<table>
<thead>
<tr>
<th>Selected VSM process steps</th>
<th>Classroom minutes</th>
<th>Sim minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pt triage</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>RN primary assessment</td>
<td>0-15</td>
<td>10</td>
</tr>
<tr>
<td>wait time</td>
<td>0-10</td>
<td>0</td>
</tr>
<tr>
<td>ERP assessment</td>
<td>5-15</td>
<td>13</td>
</tr>
<tr>
<td>wait time</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>Process pt diagnostic tests</td>
<td>30-90</td>
<td>10</td>
</tr>
<tr>
<td>Physician treatment</td>
<td>15-30</td>
<td>15</td>
</tr>
<tr>
<td>Request pediatric consult</td>
<td>5-10</td>
<td>5</td>
</tr>
<tr>
<td>wait time</td>
<td>10</td>
<td>23</td>
</tr>
<tr>
<td>learner consult initial assessment</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>wait</td>
<td>10-60</td>
<td>22</td>
</tr>
<tr>
<td>Consultant initial assessment</td>
<td>5-10</td>
<td>10</td>
</tr>
</tbody>
</table>
Conclusions

• can assist teams in selecting process changes that will have the greatest impact on process/system flow improvements

• Our measured differences between estimated and measured times for processes and delays confirms the importance of conducting in-situ exercises for correlation