Analyzing Robotic Sleeve Gastrectomy Learning Curve by Component Tasks

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Background

- Minimally invasive bariatric surgery is increasingly performed via robotic approach
- Learning curve analysis has focused on operative time or console time, but robotic system log data allows more granular analysis of specific operative steps, i.e. **component tasks**
- Example: Robotic sleeve gastrectomy (RSG) can be divided into phases of dissection (mobilization of stomach) and resection (stapling)
- **We hypothesize that learning curves for component tasks of an operation can be developed, allowing new insights into portions of a case that may be more difficult to learn**

Methods

Data Source:

- My Intuitive Application: Operative logs from the first consecutive RSG performed by an experienced bariatric fellow-ship trained minimally invasive surgeon
- Variables: Console time, dissection time, total duration of stapler utilization, average time per staple fire

Cumulative Sum (CUSUM) Analysis:

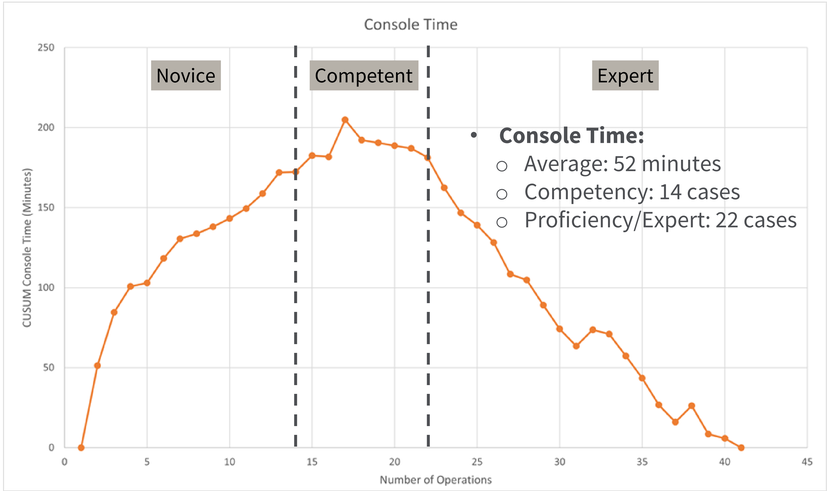
- Visualizes the learning curves
- CUSUM value is plotted in y-axis against number of operations in chronological order (x-axis), where time of interest in the individual operation is *xi* and mean time of all operations is μ

$$CUSUM = \sum_{i=1}^{n} (xi - \mu)$$

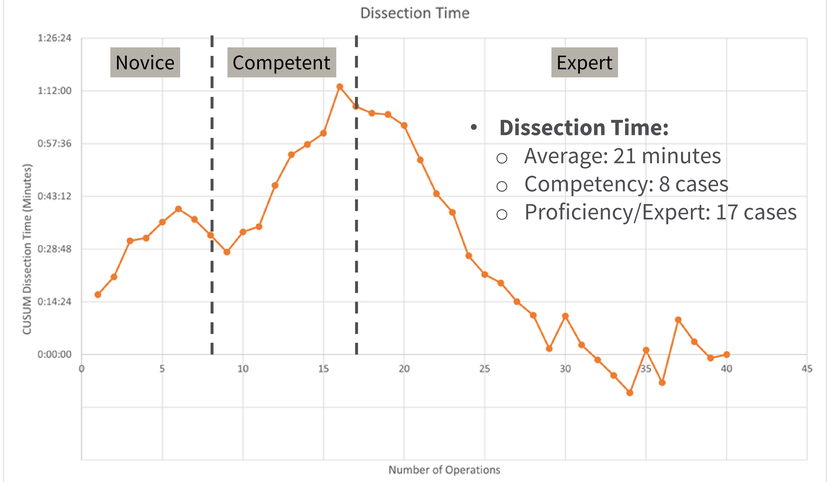
- Changes in slope indicate trends: Uphill trend corresponds to learning phase, downhill trend as learner gains competency and eventually proficiency/expertise

Results

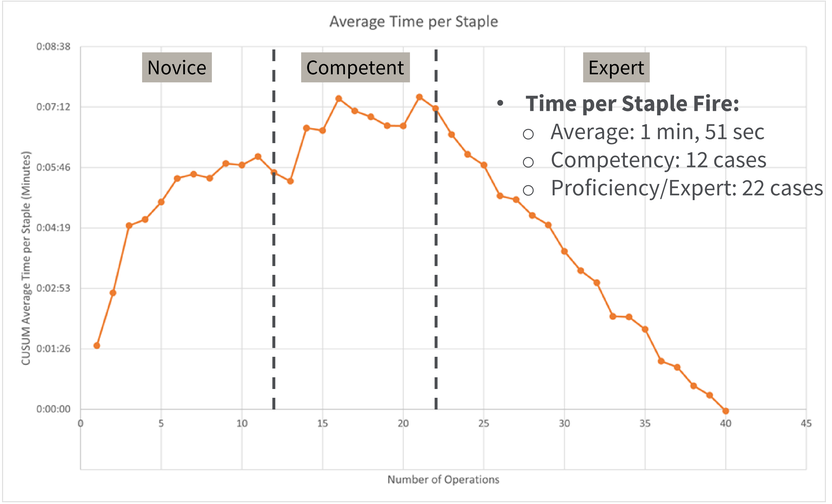
- 40 RSG cases were analyzed



- **Console Time:**
  - Average: 52 minutes
  - Competency: 14 cases
  - Proficiency/Expert: 22 cases



- **Dissection Time:**
  - Average: 21 minutes
  - Competency: 8 cases
  - Proficiency/Expert: 17 cases



- **Time per Staple Fire:**
  - Average: 1 min, 51 sec
  - Competency: 12 cases
  - Proficiency/Expert: 22 cases

Conclusions

- Robotic system log data allows analysis of specific portions of a case
- Learning curve analysis of component tasks of an operation demonstrates that each of these surgical steps may have their own learning curves
- Performing such analysis may allow identification of specific skills within a case that require additional or targeted training

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