Analyzing the Variability in Colonoscopy Appointments Using a VBA-Based Tool to Help in Improving the Schedule

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Background

Colonoscopy Procedure

- Main screening test for colorectal cancer (CRC), the second leading cause of cancer related deaths in the U.S.
- Carried out by a gastroenterologist in an endoscopy clinic.
- Allows for direct visual examination of the colon & rectum.

Challenges to Daily Colonoscopy Schedule

- Significant variability in procedure duration due to quality of pre-procedure bowel prep that the patient must undergo.
- Patient absenteeism, lack of punctuality, and cancellations.
- Patient waiting, idling, and overtimes.

Research Aim

- Develop a decision support tool to optimize colonoscopy appointment scheduling template:
  - A list of daily appointment slots to offer for patients (template)
  - Instructions for scheduling patients (scheduling policies)

Research Approach

- Observations: to learn about the domain and develop a nuanced understanding of the problem
- Data Analysis Tools: to analyze historical data and learn about the characteristics of the daily schedules
- Optimization and Simulation: to design, propose, and evaluate different optimized colonoscopy scheduling templates from which the clinic managers can select the most preferred one based on the quality of each

Do We Really Have a Problem?

- We developed a VBA-based tool to analyze the timestamps of colonoscopy appointments at the University of Michigan Medical Procedure Unit

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<thead>
<tr>
<th>Exam Date</th>
<th>Pt Name</th>
<th>Pt Class</th>
<th>App Rm</th>
<th>Prep</th>
<th>Patient Time</th>
<th>Procedure Time</th>
<th>Prep</th>
<th>Proc</th>
<th>Phase II</th>
<th>Before</th>
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<tbody>
<tr>
<td>4/3/16</td>
<td>Sain, Ana</td>
<td>Outpatient</td>
<td>Colon, H1</td>
<td>8:45</td>
<td>9:02</td>
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Future Directions

- Continue observation at the University of Michigan Medical Procedure Unit
- Use the analysis provided by the tool to obtain probability distributions for procedure duration and patient flow in the system
- Use the approximated distributions of the observed variability to optimize colonoscopy appointments schedule using an optimization based decision support tool that we are developing

Acknowledgements

- The Seth Boder Foundation
- The University of Michigan Gastroenterology Learning Community
- CHEPS students

Research Functionalities Example

(1) Variability in Procedure Duration

- Time frame: 1/1/2016 to 1/27/2017
- 3,270 conscious sedation colonoscopy records
- 2,895 of the 3,270 records retained by the tool after removing records with missing timestamps

(2) Variability in Patient Waiting Time

(3) Variability in Appointment Duration

Figure 1. Observed Colonoscopy Durations and their Proportions. According to our GI collaborators, 10-60 minutes is an observable and clinically valid range for conscious sedation colonoscopy while >75 minutes colonoscopy is far from being observed nor clinically realistic and might be in the system due to charting errors

Figure 2. Observed Waiting Times for the Procedures and their Proportions

Figure 3. Observed Appointment Durations and their Proportions