Improving Patient Flow in an Outpatient Infusion Center

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Overview:

- **Patient Arrives**
- **Phlebotomy**
- **Labs Collected**
- **Chemotherapy Infusion**
- **Patient Discharged**

**Lab Process Analysis**

**Background:**
- Lab results needed: (1) by provider before clinic appointment to assess patient and (2) by pharmacy to initiate drug preparation/infusion process
- Concerned about (1) patient waiting time (2) balanced phlebotomist workload (3) lab results being available within 1 hour

**Methods:**
- Workflow analysis and time study of blood draw area
- Discrete event simulation of patient flow through area
- Table Top Simulation for education and brainstorming

**Findings:**

<table>
<thead>
<tr>
<th>Step</th>
<th>Mean Time (Std Dev) in Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient waits for check-in</td>
<td>2.67 (3.92)</td>
</tr>
<tr>
<td>Check-in</td>
<td>3.27 (2.15)</td>
</tr>
<tr>
<td>Patient waits for call back</td>
<td>4.38 (5.64)</td>
</tr>
<tr>
<td>Blood draw</td>
<td>Vein: 5.11 (3.75) Port: 13.28 (4.64)</td>
</tr>
<tr>
<td>Batch</td>
<td>15.16 (4.15)</td>
</tr>
<tr>
<td>Prepare and send capsule</td>
<td>1.49 (1.03)</td>
</tr>
</tbody>
</table>

- Total processing time (blood draw and lab analysis) exceeds one hour threshold (blood draw alone accounts for 34.12 min, on average)
- Current Work: Simulation will allow us to test and measure the impact of different “what if” scenarios on the patient flow

**Pharmacy Pre-mix Tool**

**Background:**
- Infusion drugs are expensive and their use uncertain (e.g. patient cancellation). Thus, pharmacy does not prepare most drugs in advance
- "Pre-mixing" may help improve patient waiting times/workload balance

**Methods:**
- Collected and analyzed data on prices, treatment times, deferral rate, etc.

**Table:**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Effect on Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug cost</td>
<td>Low cost → Higher priority</td>
</tr>
<tr>
<td>Probability of deferral or dosage change</td>
<td>Low probability → Higher priority</td>
</tr>
<tr>
<td>Number of patients receiving drug</td>
<td>Higher number of patients → Higher priority</td>
</tr>
</tbody>
</table>

- Current Work: Developing optimization model to determine which drugs should be prepared in advance

**Maximize:**

Trade-off between projected savings (wait time and workload) vs. risk of drug waste

**Subject to:**
- Capacity: You can only make X amount of drugs at a time
- Time: Drugs have to be made within the pre-mix period

**Chemotherapy Infusion Scheduling**

**Background:**
- Patient wait ~45 minutes after arrival at infusion until being seated in a chair, due to high treatment time variability
- Possible Solution: Improved scheduling of infusion patients could result in reduced total length of operations and patient wait time

**Methods:**
- Considering patient acuity, age, and other characteristics can be used to tailor appointment lengths to each patient
- Using appointment templating, more consistent and reliable schedules can be created for patients

**Findings:**
- Allowing extra time for highly variable treatments and increasing appointment lengths in the middle of the day help to prevent and recover from propagating delays
- Next Steps: Incorporate patient acuity into model, develop and implement scheduling guidelines

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