Improving Patient Flow and Resource Utilization in an Ambulatory Cancer Clinic through Simulation Modelling

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Background

- Site of consultation for cancer outpatients with physicians and clinics
- Located at the Vancouver Centre, largest of five centres in the province
- Provides three types of treatment programs: Medical Oncology, Radiation Oncology and Surgical Oncology
- There are three patient types within each program: New Patients (NP), Follow-up Patients (FU) and Inter-progamt Consultants (C)
- About 200 patients per day; more than 50,000 appointments in 2007/2008

A typical patient flow:

Results

- Lack of exam rooms, physicians' space and patient waiting area to provide optimal care for patients
- Increasing patient volumes, with 9% annual increase over last five years
- Increasing demand for clinical trials, academic / teaching duties and new information technology assisted care (i.e. electronic charts and tele-health) are changing resource requirements at the ACU
- Concern about the patient experience (i.e. excessive wait times) during their visit to the centre

One of the aims of the project is to reduce non-value added time.

Methodology

1. Data Analysis
   - Selected modelling technique is discrete event simulation
   - Emulates patient flow from arrival until exam room departure, seizing limited resources such as doctors and exam rooms
   - Incorporates randomness and variability present in the process (i.e. random patient arrivals, doctor arrivals, consultation durations, process times, etc.)
   - Considers multiple clinics, participation of students and residents, and multiple exam rooms
   - Validated against collected data; deemed accurate for analysis
   - 100 one-month replications simulated, each month comprising 911 clinics and 4,435 patients

Simulation Model

Input
- Clinic schedules
- Outpatient scheduling
- Exam allocation
- Resource availability
- Others

Output
- Patient wait time
- Clinic duration
- Doctor idle time
- Exam / wait room utilization

Scenario: Change in Average Wait Time

<table>
<thead>
<tr>
<th>Change in Average Wait Time</th>
<th>Current State</th>
<th>Dedicated Room Allocation</th>
<th>Dynamic Room Allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Significant Change</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Changes to Current State</td>
<td>20%</td>
<td>40%</td>
<td>-20%</td>
</tr>
<tr>
<td>1st Consult</td>
<td>30%</td>
<td>60%</td>
<td>100%</td>
</tr>
<tr>
<td>2nd Consult and Exit Room</td>
<td>40%</td>
<td>60%</td>
<td>-100%</td>
</tr>
<tr>
<td>3rd Consult and Exit Room</td>
<td>60%</td>
<td>120%</td>
<td>100%</td>
</tr>
<tr>
<td>Exit Room</td>
<td>100%</td>
<td>120%</td>
<td>-100%</td>
</tr>
</tbody>
</table>

Exam Room Reduction vs. Dedicated Room Allocation

- Under the current Dedicated Room Allocation configuration, each clinic is designated a fixed number of exam rooms
- In the proposed Dynamic Room Allocation configuration, clinics within each program can share the same pool of rooms

Recommendations

- Allocate exam rooms more flexibly and dynamically among clinics and programs (i.e. Medical, Radiation and Surgical Oncology)
- Promote punctuality to avoid delays in the start and running of the clinic
- Schedule realistically (i.e. avoid double booking add-ons and account for variability) to reduce patient wait times
- Re-evaluate scheduling practices (for each physician) to ensure accurate booking of appointments
- Pilot recommended changes on several clinics followed by the entire ACU
- Utilize model to support future renovation initiatives

Survey data from staff and physicians on pressure points

Qualitative data from patients on their experience

“WHAT IF” scenarios were tested using the model to determine the impact on patient wait time, clinic duration and resource utilization.

- Tested scenarios are a combination of the following factors and corresponding levels:

Clinic Start

<table>
<thead>
<tr>
<th>Appointment order</th>
<th>Appointment Duration</th>
<th>Appointment Add-Ons</th>
<th>Appointment Adjustment</th>
<th>Exam Rooms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>Current</td>
<td>Current</td>
<td>Current</td>
<td>Current</td>
</tr>
<tr>
<td>FU-C-NP</td>
<td>15% increases</td>
<td>Schedule to the end of the clinic</td>
<td>Adjust to average oncologist turnaround</td>
<td>Pooled pod configuration</td>
</tr>
<tr>
<td>NP-C-FU</td>
<td>30% increases</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NU-C-NP-C</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Sensitivity Analysis on Exam Room and Wait Times Under Dynamic Room Allocation

<table>
<thead>
<tr>
<th>Sensitivity Analysis on Exam Room and Wait Times</th>
<th>No Significant Change</th>
<th>Changes to Current State</th>
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</thead>
<tbody>
<tr>
<td>Exam Room Configuration</td>
<td>100%</td>
<td>20%</td>
</tr>
<tr>
<td>Changes to Current State</td>
<td>10%</td>
<td>40%</td>
</tr>
<tr>
<td>1st Consult</td>
<td>40%</td>
<td>-20%</td>
</tr>
<tr>
<td>2nd Consult and Exit Room</td>
<td>60%</td>
<td>-60%</td>
</tr>
<tr>
<td>3rd Consult and Exit Room</td>
<td>80%</td>
<td>100%</td>
</tr>
<tr>
<td>Exit Room</td>
<td>100%</td>
<td>-100%</td>
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</tbody>
</table>

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