Scheduling and Patient Flow in an Outpatient Chemotherapy Infusion Center

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Cancer and Cancer Treatment

• Cancer Statistics
  – In 2014 there will be an estimated 1,665,540 new cancer cases
  – Second leading cause of death in the United States

• Chemotherapy Infusion Center
  – Facility where cancer treatment is given on an outpatient basis
  – Over 50% of all cancer patients receive chemotherapy treatment

University of Michigan Comprehensive Cancer Center

- 93,319 outpatient visits annually
- 51,884 infusion treatments annually
- 5% increase in patient volume annually

University of Michigan Cancer Center
Project Goals

• Improve quality of cancer care delivery in the infusion center
  – Reduce patient waiting times
  – Reduce total length of day of operations
  – Others:
    • Promote equity in nurse workload
    • Improve patient and nurse safety
    • Reduce cost associated with pharmaceutical waste
Project Initiatives

- **Patient Arrives**
  - Labs Collected
  - Clinic Appointment
  - Infusion
  - Pharmacy
  - Patient Discharged

**Analyzing idea of uncoupling labs**

**Quantifying lab processing delays and recommending improvements**

**Stochastic optimization to improve infusion scheduling**

**Dynamic decision tool focused on preparing more drugs in advance**
Additional Motivation

Daily Average Lab Appointments

50% of work before 10:30 AM

- Infusion
- Lab Before Clinic
- Lab After Clinic
- Clinic & Infusion
- None
- Phlebotomist Capacity
Decoupling of Visits

Day 1:
- Lab

Day 2:
- Clinic
- Infusion
Assessing Decision of Decoupling

Decoupling becomes beneficial when roundtrip travel time and lab draw time < 1 hour

**Advantages**
- Reduce patient wait times on day of infusion or clinic visit
- Reduce UMHS Cancer Center lab workload in morning

**Disadvantages**
- Patients must complete two visits
Feasibility of Decoupling Visits

• Survey results indicate 9% of patients interested in a 2 day schedule

![Patient Reasons for Opposing a 2 Day Schedule]

Data Source: Infusion Survey of Patients on Monday, June 10, 2013. 251 Responses.
Methods

• Pulled data from electronic health record for Aug 2012 – Feb 2013 (9429 patients)
  – Patient addresses contained in this data set
• Calculate distance and driving duration for each patient address to the UMHS Cancer Center
Methods

- Google Maps API used to determine distance and driving duration from patient addresses to UMHS Cancer Center
Quantifying Driving Time to UMHS

Histogram of Patient Driving Time to Cancer Center
Clarity Data Aug 2012 – Feb 2013 (9429 patients)
Excludes patients with driving time > 4 hours

<table>
<thead>
<tr>
<th>Driving Duration</th>
<th>Percent of Unique Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 30 min</td>
<td>29%</td>
</tr>
<tr>
<td>30-60 min</td>
<td>36%</td>
</tr>
<tr>
<td>60-120 min</td>
<td>22%</td>
</tr>
<tr>
<td>120-240 min</td>
<td>9%</td>
</tr>
<tr>
<td>Over 4 hours</td>
<td>4%</td>
</tr>
</tbody>
</table>
Patient Location in Michigan

- 9 satellite lab facilities in Southeast Michigan
Methods

• Labs can be drawn at any of 9 satellite facilities associated with UMHS
Driving Time to Closest Lab Facility

Histogram of Patient Driving Time to Closest Lab Facility
Clarity Data Aug 2012 - Feb 2013 (9429 Patients)
Excludes patients with driving time > 4 hours

Driving Time (min)
Frequency

- 0 - 40
- 40 - 80
- 80 - 120
- 120 - 160
- 160 - 200
- 200 - 240

- 0
- 500
- 1000
- 1500
- 2000
## Results of Satellite Facilities Analysis

<table>
<thead>
<tr>
<th>Driving Duration</th>
<th>Percent of Patients to Satellite Facilities</th>
<th>Percent of Patients to Cancer Center</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 30 min</td>
<td>52%</td>
<td>29%</td>
</tr>
<tr>
<td>30-60 min</td>
<td>23%</td>
<td>36%</td>
</tr>
<tr>
<td>60-120 min</td>
<td>15%</td>
<td>22%</td>
</tr>
<tr>
<td>120-240 min</td>
<td>7%</td>
<td>9%</td>
</tr>
<tr>
<td>Over 4 hours</td>
<td>3%</td>
<td>4%</td>
</tr>
</tbody>
</table>
Results of Satellite Facilities Analysis

• Conservatively, encourage decoupling visits for patients within 15 minutes of satellite facility
  – 32% of patients
Conclusion

• Patients live closer to UMHS and satellite facilities than perceived by Cancer Center providers and staff
• Encourage decoupling of visits for patients within close proximity
• Educate patients on utilizing satellite facilities
Future Work

• Pilot decoupling of visits
  – Barriers: Physician workflow differs with lab location

• Investigate alternative improvements to lab process
  – “Fast track” phlebotomist
  – Prioritizing lab processing
Acknowledgements

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CHEPS & the HEPS Master’s Program

- **CHEPS**: The Center for Healthcare Engineering & Patient Safety
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- CHEPS and HEPS offer unique multidisciplinary teams from engineering, medicine, public health, nursing, and more collaborating with healthcare professionals to better provide and care for patients
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Thank You!

Questions?

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