Scheduling and Patient Flow in an Outpatient Chemotherapy Infusion Center

ISERC
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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
Patient Flow

Patient Arrives

Lab Collection

Clinic Appointment

Infusion

Pharmacy Preparation

Patient Discharged

Wait ~1 hour

Wait 1-2 hours

Wait ~1 hour

Wait ~20 minutes

1-8 hours
Patient Flow

Lab processing time $\geq 1$ hour

- Labs reviewed
- Labs reviewed
- Labs reviewed

Patient Arrives

Lab Collection

Wait $\sim 1$ hour

Clinic Appointment

Wait

Infusion

Wait $\sim 1$ hour

Pharmacy Preparation

1-2 hours

Wait

Patient Discharged

Wait $\sim 20$ minutes
Additional Motivation

- Labs can be collected within 48 hours of infusion appointment

Source: Electronic health record data. April 7-11, 2014.
Decoupling of Visits

Day 1: Lab

Day 2: Clinic Infusion
Assessing Decision of Decoupling

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Reduce patient wait times on day of infusion</td>
<td>• Patients must complete two visits</td>
</tr>
<tr>
<td>• Reduce UMHS Cancer Center lab workload in morning</td>
<td></td>
</tr>
</tbody>
</table>

Decoupling becomes beneficial when roundtrip travel time and lab draw time < 1 hour.
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 between patient addresses and 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

- Driving Duration
- Percent of Unique Patients
  - Less than 30 min: 29%
  - 30-60 min: 36%
  - 60-120 min: 22%
  - 120-240 min: 9%
  - Over 4 hours: 4%
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
## 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

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

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Questions?

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