IMPROVING PATIENT FLOW IN AN OUTPATIENT CHEMOTHERAPY INFUSION CENTER

Pamela Martinez Villarreal
Matthew Rouhana
Agenda

- The Team
- Cancer Background
- Infusion Overview
- Project Initiatives
The Team

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Ajaay Chandrasekaran
Chhavi Chaudhry
Amy Cohn, Ph.D.
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Nursing Student
Industrial and Operations Engineering
Computer Science Student
Industrial and Operations Engineering Student
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Patient & Family Advisory Board (PFAB)
Professor, Internal Med., Hematology/Oncology
Clinical Care Coordinator, Infusion
Nursing Student
Supervisor, Department of Pathology
Industrial and Operations Engineering
The Team

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Harry Neusius  
Donald Richardson, Ph.D Pre-Candidate  
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Jonathan Zhou

Nurse Supervisor, Infusion  
Manager, Department of Pathology  
Industrial and Operations Engineering  
Nursing Graduate  
Associate Supervisor, Department of Pathology  
Nursing Graduate  
Nurse Manager, Infusion  
Operations Manager, Infusion  
Medical Director, UMCCC  
Pre-Medical Student
Cancer Statistics

– Second leading cause of death in the United States

– In 2015, there will be an estimated 1,658,370 new cancer cases diagnosed and 589,430 cancer deaths in the US.

Source:
In 2014, over 50% of outpatient visits in the UMCCC resulted in chemotherapy infusion treatments:

- 97,147 outpatient visits
- 58,419 infusion treatments

Variable infusion treatment times (30 min – 8 hr)

Our Goal

Reduce patient waiting times and improve their full-day experience
Infusion Overview

8 AM
- Patient Arrives
- Phlebotomy
- Lab Processing

9 AM
- Clinic

10 AM
- Infusion
- Patient Discharged

Legend:
- Patient Flow
- Information Flow
- Material Flow
Infusion Overview

- Patient Arrives
- Phlebotomy
  - Lab Processing
- Clinic
- Pharmacy
- Infusion
- Patient Discharged

Flow types:
- Patient Flow
- Information Flow
- Material Flow
Chemotherapy Infusion

On average, patients wait ~45 minutes after arrival at infusion until they are seated in a chair.

Project Initiative:
Improved Scheduling of Infusion Patients
Improved Scheduling of Infusion Patients:

1) Stochastic Optimization


- Allow extra time for highly variable treatments
- Increase appointment lengths in the middle of the day
Improved Scheduling of Infusion Patients:

2) Patient Acuity Model
   • Reduce variability in patient appointment lengths

3) Appointment Templating
   • Schedule appointments more effectively using templates for different care cycles
Drugs not being ready could delay a patient’s appointment

Project Initiative:

**Pre-Mixing Drugs**
Pre-mixing Drugs:

- Pharmacy prepares drugs for infusion
  - Some are very expensive
  - Risk of waste

- Drugs prepared once patient arrives at infusion
Pre-mixing Drugs:

– “Pre-mixing” may help improve patient waiting times/workload balance

– Evaluate trade-offs of improved wait/workload vs. risk of drug waste

– **Optimizing which Chemotherapy Drugs to Pre-Mix and When**
  
  • Donald Richardson
  
  • **FA08** - Friday, 8:00-9:30 AM session, Student Research Projects in Healthcare Operations
Lab results needed:

- by **provider** before clinic appointment to assess patient
- by **pharmacy** to initiate drug preparation

**Project Initiative:**

**Uncoupling Appointments**
Phlebotomy

Uncoupling Appointments

- Option to have labs done at least one day prior to clinic appointment at any MLab facility

<table>
<thead>
<tr>
<th>Driving Duration</th>
<th>% of Patients to Closest Lab Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 15 min</td>
<td>32%</td>
</tr>
<tr>
<td>15 – 30 min</td>
<td>20%</td>
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<tr>
<td>30 – 60 min</td>
<td>23%</td>
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<tr>
<td>1 – 2 hours</td>
<td>15%</td>
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<tr>
<td>2 – 4 hours</td>
<td>7%</td>
</tr>
<tr>
<td>Over 4 hours</td>
<td>3%</td>
</tr>
</tbody>
</table>

Where do UMCCC patients live?
Project Initiatives: **Discrete Event Simulation**

Phlebotomy goal is to consistently have lab results in a **one-hour turnaround** window (from patient arrival to phlebotomy and their next appointment)
## Discrete Event Simulation

### Pre-Examination Blood Draw

<table>
<thead>
<tr>
<th>Activity</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient waits to be checked-in</td>
<td>13 min</td>
</tr>
<tr>
<td>Check-In</td>
<td>2.55 min</td>
</tr>
<tr>
<td>Patient waits to be called to the back</td>
<td>16 min</td>
</tr>
<tr>
<td>Blood Draw</td>
<td>3.52 min</td>
</tr>
<tr>
<td>Batch</td>
<td>20 min</td>
</tr>
<tr>
<td>Prepare and send capsule</td>
<td>1.43 min</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Total</strong></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>7.5 min (Value Added)</td>
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<tr>
<td>49 min (Non-Value Added)</td>
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- 2014 PHLEBOTOMY TIME STUDIES
Discrete Event Simulation

1) Computer Simulation Tool:
- Can help visualize and analyze current operations
- Test and measure the impact of different “what if" scenarios without having to carry them out
  - What if patients were able to check themselves in?
  - What if we add a permanent medical assistant to the staff?
Phlebotomy Layout and ProModel Simulation
Discrete Event Simulation

2) Table-Top Simulation:
   - Hands-on activity
   - Engage the whole team
   - Educational component
   - Brainstorm ideas
Future Work

**Improved Scheduling of Infusion Patients:**
- Incorporate acuity and improve scheduling templates and protocols

**Pre-mixing Drugs Tool:**
- Assist in deciding which drugs to prepare and when

**Discrete Event Simulation:**
- Simulate different “what if" scenarios to test and measure their impact in the process
Thank you!

QUESTIONS?

CONTACT INFORMATION:

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Pamela Martinez – mvpamela@umich.edu
Matt Rouhana – mrouhana@umich.edu
Value Stream Map for Processing of CBCD
STAT Specimens from the Cancer Center

Last Updated: 9/5/2014

Data Sources:
*: Time study performed by Corrie Pennington-Block
†: Time study performed by Sarah Bach
#: Hematology TAT data (Aug 2014)
X: Cancer Center Blood Draw TAT Data (July 2014)

About 20% of tubes require additional processing

Pre-Examination (CC Blood Draw)
- Avg. (SD) Time: 2.55 min (0.95 min)
- Avg. (SD) Time: 3.52 min (0.47 min)
- Avg. (SD) Time: 1.43 min

Check In
- Greet patient
- Enter in MiChart
- SOFT
- Assemble papers, labels, card, and place on counter
- Problem solve, if necessary

Blood Draw
- Pick up papers, call patient back
- Walk patient back, verify date of birth
- Draw blood
- Wrap up, label tubes, place tubes in bin

Pneumatic Tubing
- Place tubes in capsule
- Hit send on pneumatic tube to Specimen Processing

Tube Travel Time
- Pneumatic tube travels from Cancer Center Blood Draw to Specimen Processing

Specimen Processing
- Take specimen bags out of pneumatic tube
- Walk tubes directly to Hematology Lab

Specimen Processing

Hematology Processing
- Scan barcode of tube
- Mix blood
- Aspirate blood
- Flag abnormal values, if abnormal send to stain machine to prepare slide for manual read

Hematology Lab
- Avg. (SD) Time: 12 min (19.6 min)
- < 30 min: 3 (2.28 min)
- > 30 min: 51 (10.9) min

Delays caused by missing/incorrect orders

Patient arrives

Results uploaded from SOFT to MiChart directly

Patient leaves
## Pre-Examination Blood Draw

<table>
<thead>
<tr>
<th>Description</th>
<th>Mean (Standard Deviation)</th>
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<tbody>
<tr>
<td>Patient waits to be checked-in</td>
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<tr>
<td>Check-In</td>
<td>3.12 min (2.10 min)</td>
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<td>Patient waits to be called to the back</td>
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<tr>
<td>Blood Draw</td>
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<tr>
<td>Vein:</td>
<td>4.99 min (2.38 min)</td>
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<tr>
<td>Port:</td>
<td>13.60 min (4.44 min)</td>
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<tr>
<td>Batch</td>
<td>17.63 min (3.92 min)</td>
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<tr>
<td>Prepare and send capsule</td>
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(Value Added)

(Non-Value Added)

- 2015 PHLEBOTOMY TIME STUDIES
Appendix

- Phlebotomy – 253 patients per day
- Clinic (7 Total) – 311 patients per day
- Infusion – 123 patients per day
  - 20% of infusion appointments are coupled
## Appendix

- **Staff Schedule**

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<th>Time</th>
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<td>Clinic Sweep</td>
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<tr>
<td>Breaks/Lunches</td>
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<td>Part Time/Day Off</td>
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**Totals do not include the Associate Supervisor**

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