Improving Patient Access and Adherence to an Endocrine Program

Pranjal Singh
Amy Cohn, PhD
Amy Rothberg, MD
Collaborators of the Project

Amy Cohn, PhD\textsuperscript{1,2}  
Amy Rothberg, MD\textsuperscript{3}  
William Herman, MD\textsuperscript{3}  

\textbf{Staff}  
Yu-Hei Moses Chan, MSE\textsuperscript{1}  

\textbf{Student}  
Cara Cheshire\textsuperscript{1}  

\textsuperscript{1} Center for Healthcare Engineering and Patient Safety, University of Michigan, Ann Arbor  
\textsuperscript{2} Department of Industrial and Operations Engineering, University of Michigan, Ann Arbor  
\textsuperscript{3} Department of Internal Medicine, University of Michigan Health System
The University of Michigan Weight Management Program (WMP) is a two-year program
- Intense energy restriction
- Behavioral change

26 total visits required over two years
Patients must attend ≥80% of scheduled appointments
- First month of program requires more frequent visits

Problem Statement

Access
- Patients waiting too long to get into program

Adherence
- Patients are not able to adhere to the program’s structured visit timeline
Approaching the Problem

• We designed a temporal database to analyze:
  o Capacity Dynamics
  o Patient Behavior

• The stages of the database are:
  1. Slot
  2. Appointment Opportunity
  3. Provider Template
  4. Appointment Schedule
  5. Appointment Schedule Snapshots
• Basic building block of the database
• Represents single 15 minute time period
• Corresponds to a single record in the database
• Defined by:
  o Provider Name
  o Slot Date
  o Slot Time

<table>
<thead>
<tr>
<th>Slot</th>
<th>Provider “A”</th>
<th>7/17/2014</th>
<th>9:15 AM</th>
</tr>
</thead>
</table>

Slot
**Appointment Opportunity**

- **Appointment Opportunity** represents single placeholder for a patient appointment.
- Appointment Opportunities are created expecting:
  - Return Visit (Single Slot)
  - New Patient (Multiple Slots)
- Defined by:
  - Appointment Length
  - Appointment Type
  - Slot Number in Appointment
  - Total Number of Slots in Appointment
Provider Template

- Represents all possible Appointment Opportunities over a given timeframe
- This template is an aggregated schedule of each provider’s general availability to see patients
- This excludes information about intermittent unavailability, e.g.
  - Out of office for conference
  - Vacation leave
  - Administrative duty

<table>
<thead>
<tr>
<th>9/14/2015</th>
<th>9/15/2015</th>
<th>9/16/2015</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appointment Schedule

- Represents *Provider Template* overlaid with:
  - Each provider’s intermittent unavailability
  - Patient appointment data
- Some *Appointment Opportunities* are occupied by patient appointments

<table>
<thead>
<tr>
<th></th>
<th>9/14/2015</th>
<th>9/15/2015</th>
<th>9/16/2015</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appointment Schedule Snapshots

• On each day (M-F), we view the Appointment Schedule
• Each day’s view represents an Appointment Schedule Snapshot
• We compare two consecutive Appointment Schedule Snapshots and capture changes from one to another, e.g.
From 7/15/2014 – 4/29/2016:

**New Patients**
- 25% of scheduled appointments were cancelled
- Of cancelled appointments, 90% were rescheduled

**Return Visits**
- 34% of scheduled appointments were cancelled
- Of cancelled appointments, 76% were rescheduled
Major Questions for Analysis

Capacity Dynamics
1. How easy is it to schedule an appointment “X” weeks into the future?
2. How far into the future are “X” slots available for scheduling?

Patient Behavior
1. How long is an appointment held before it gets cancelled?
How easy is it to schedule an appointment “X” weeks into the future?
How far into the future are “X” slots available for scheduling?

How far into the future are “X” slots available for scheduling?

(New Patients)

Number of Empty Slots vs. Days

Mean

Median
How long are people holding their appointments before they cancel?

How long are people holding their appointments before they cancel?

**Ratio** = \( \frac{\text{Appointment Holding Time}}{\text{Appointment Lifetime}} \)
Analysis (cont’d)

Appointment Lifetime ≤ 1 Week

Appointment Holding Time Ratio

Frequency

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 1.1

N = 56
Analysis (cont’d)

1 Week < Appointment Lifetime ≤ 1 Month

N = 765

Appointment Holding Ratio

Frequency
Analysis (cont’d)

1 Month < Appointment Lifetime ≤ 3 Months

N = 2522
Analysis (cont’d)

3 Months < Appointment Lifetime ≤ 6 Months

N = 1306
Analysis Summary

• Difficult to see new patients within the first month of the clinic’s schedule
  o Variability reduced in long term
• Utilization impacted by appointment holding times
Ongoing Work

• Look at the impact of seasonality on utilization metrics
• Track utilization of a particular slot over a specified duration of time
  o How is that slot changing?
• Look at priority of waitlists
Acknowledgements

• The Seth Bonder Foundation
• The Metabolism, Endocrinology & Diabetes Clinic
• Center for Healthcare Engineering and Patient Safety
• University of Michigan College of Engineering
• University of Michigan Medical School
Thank you!

Pranjal Singh
pranjsin@umich.edu

Amy Cohn
amycohn@umich.edu

Amy Rothberg
arothber@umich.edu