Improving Access to an Outpatient Endocrinology Clinic

Moses Y. H. Chan, MSE
Amy Rothberg, MD
William Herman, MD, MPH
Amy Cohn, PhD
Collaborators

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

Faculty and Staff  
Luis Garcia-Guzman, PhD\textsuperscript{2}  
Rodney Capps III\textsuperscript{2}

Students\textsuperscript{1}  
Henry Ballout  
Nathan Janes\textsuperscript{2}  
Madalina Jiga  
Paige Mollison\textsuperscript{2}  
Nina Scheinberg\textsuperscript{2}  
Haitian Sun\textsuperscript{4}

\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  
\textsuperscript{4} Department of Computer Science and Engineering, University of Michigan, Ann Arbor
Background

• 14.5% of US adults moderately or severely obese (NHANES 2011 – 2012)

• High risk of chronic diseases
  – Diabetes, hypertension, coronary artery disease

• High cost
  – $245 billion for diagnosed diabetes (ADA 2012)
  – 1 of 5 health care dollars attributed to diabetes
Weight Management Program (WMP)

- 2-year program designed by Amy Rothberg, MD
- Partnership with Blue Care Network
- Eligibility
  - $\text{BMI} \geq 32 \text{ kg/m}^2$ with 1 or more comorbidities
  - $\text{BMI} \geq 35 \text{ kg/m}^2$
**Program Protocol**

- Regimented recurrent MD and Registered Dietitian (RD) visits
  - Phase 1: Intensive caloric restriction
  - Phase 2: Weight maintenance
- Strict visit schedule for effectiveness

<table>
<thead>
<tr>
<th>Before Program</th>
<th>Week of Program (100 Weeks Total)</th>
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<tbody>
<tr>
<td>New Patient (MD)</td>
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5 weeks before program start.
Challenges of Scheduling

- MDs booked weeks out
- Patients not seen according to protocol

Goal

Ensure timely access

AND

Provide adequate capacity for patients to adhere to the program
New Opportunity

- Program implementation in primary care clinics
- No current patients
- Designated time blocks
Solution Approach

• Patient Template
  – Set up appointments for entire schedule
  – Remind upcoming appointments at each visit
Model Assumptions

• New patient appointment is part of template
• MD visit right after RD visit
• Consistent appointment start time
## Schema of Scheduling Problem

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<tr>
<th>Week</th>
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Model Parameters

\[ \begin{align*}
W & \quad \text{number of weeks in horizon} \\
D & \quad \text{number of days in a week} \\
S & \quad \text{number of slots in a day} \\
L & \quad \text{length of program, in weeks} \\
P & \quad \text{number of patients to be scheduled}
\end{align*} \]
Model Parameters

\[ \delta^M_{w_s d_s s w_c d_c s_c}, \delta^R_{w_s d_s s w_c d_c s_c} \]

1 if a patient starts on week \( w_s \), day \( d_s \), and slot \( s_s \)

occases an MD, RD slot on week \( w_c \), day \( d_c \), and slot \( s_c \),

0 otherwise

\[ c^M_{w_c d_c s_c}, c^R_{w_c d_c s_c} \]

capacity of MD, RD on week \( w_c \), day \( d_c \), slot \( s_c \)
Model Variable

$x_{wds}$

1 if there is a patient starting program on week $w$, day $d$, and slot $s$, 0 otherwise
Model Constraints

A patient has to start program once and only once

\[
\sum_{w=1}^{W} \sum_{d=1}^{D} \sum_{s=1}^{S} x_{wds} = P
\]

(1)
Model Constraints (cont’d)

MD and RD capacity

\[
\sum_{w_s=1}^{w_c} \sum_{d_s=1}^{d_c} \sum_{s_s=1}^{s_c} \delta_{w_s d_s s_s}^{M/R} w_c d_c s_c x_{w_s d_s s_s} \leq c_{w_c d_c s_c}^{M/R}
\]

\(w_c \in \{1..W\}\)

\(d_c \in \{1..D\}\)

\(s_c \in \{1..S\}\)

(2)
Model Objective Function

Start all patients as soon as possible

$$\min \ z$$

Maximum starting week

$$w x_{wds} \leq z$$

$$w \in \{1..W\}$$
$$d \in \{1..D\}$$
$$s \in \{1..S\}$$

(3)
Relaxation of Assumptions

- Separate new patient appointment and patient template
- Separate MD and RD appointments
- Allow deviation in appointment time
Next Steps

• Develop scheduling guideline
  – Cover withdrawal, cancellation, and no-show
• Develop training materials
• Provide training to schedulers
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THANK YOU!

Contact Info:

mosesyhc@umich.edu
amycohn@umich.edu