Improving Access to an Outpatient Endocrinology Clinic

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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
  – BMI ≥ 32 kg/m² with
    1 or more comorbidities
  – BMI ≥ 35 kg/m²
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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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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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

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

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

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

0 otherwise

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

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

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

\[
\begin{align*}
w_c & \in \{1..W\} \\
d_c & \in \{1..D\} \\
s_c & \in \{1..S\}
\end{align*}
\]

(2)
Model Objective Function

Start all patients as soon as possible

$$\min \ z$$

Maximum starting week

$$wx_{wds} \leq z$$

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

(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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- Bonder Foundation
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THANK YOU!

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