Ensuring timely access and adequate capacity for an endocrinology clinic

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Background

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

• High risk of chronic diseases
  – Type 2 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

- 2-year program designed by Amy Rothberg, MD
- Promote weight reduction
- Support behavioral change
- Basic eligibility
  - $\text{BMI} \geq 32$ kg/m$^2$ with 1 or more comorbidities
  - $\text{BMI} \geq 35$ kg/m$^2$
Program protocol

- Regimented visits to Registered Dietitian (RD) and MD
- Strict visit schedule for effectiveness

<table>
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<tr>
<th>Before Program</th>
<th>New Patient (MD)</th>
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<th>Week of Program (100 Weeks Total)</th>
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<td>1 2 3 4 5 6 7 8 ...</td>
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What’s the problem?

- Provider overbooked by non-program patients
- Patients not seen according to protocol
Unified data storage

- Data: 2 spreadsheets daily
- Build MySQL-based database
- Store information about appointments in rolling horizon basis
- Compare views of appointments from one day to another
What we learned from clinic data

Provider capacity looking 18 weeks out

Weeks into Future

Filled Capacity

0% 100%

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

Full/Beyond capacity
Started to free up after 5th week
Open after 12th week

Snapshot as of July, 2015
What we learned from clinic data

How long before an appointment are cancellations made? \( N = 1,514 \)

Over 50% of cancellations were made within 1 week before appointment.
Study objectives

• Increase patient access to the program
• Ensure capacity for program (time-sensitive) patients
• Improve patient adherence to the program
Our approach

The **OPT** solution package:

1. **Optimization**
   Recommend plan of new patient (NP) intake

2. **Policy**
   Develop standard operating procedures for handling program patients

3. **Training**
   Provide training to sites
Challenges in implementing change

• Equity
  – How about the current program patients?

• Culture
  – Resistance to change
  – How do we ensure improvement?

“It may be hard for an egg to turn into a bird: it would be a jolly sight harder for it to learn to fly while remaining an egg.” – C.S. Lewis
Greenfield opportunity

- Program implementation in primary care sites
- No current program patients
Our approach

The **OPT** solution package:

1. **Optimization**
   Recommend plan of new patient (NP) intake

2. **Policy**
   Develop standard operating procedures for handling program patients

3. **Training**
   Provide training to sites
Optimization model

Sets/Parameters

\(P\) patients

\(W\) weeks in planning horizon

\(W^s \subset W\) starting weeks

\(V_s \subset W\) weeks patient is expected to visit the clinic if patient has started in week \(s\)

\(N^W\) maximum number of weeks between NP and program start
OPTIMIZATION MODEL

**VARIABLES**

\[ x_{p,s} \in \{0, 1\} \] if patient \( p \) has NP assessment visit in week \( s \)

\[ y_{p,s} \in \{0, 1\} \] if patient \( p \) starts program in week \( s \)

\( u_w \) capacity utilization in week \( w \)

**CONSTRAINTS**

\[ \sum_{s \in W_s} x_{p,s} = 1 \forall p \in P \] Every patient should have one NP visit

\[ \sum_{s \in W_s} y_{p,s} = 1 \forall p \in P \] Every patient should start program once

\[ \sum_{p \in P} \left( x_{p,w} + \sum_{s \in W^s : w \in V_s} y_{p,s} \right) = u_w \forall w \in W \] Number of patients in each week

\[ 0 \leq \sum_{s \in W} s y_{p,s} - \sum_{s \in W} s x_{p,s} \leq N^W \forall p \in P \] Timing between program start and NP
Scheduling Policy

• Change process of scheduling appointments
• Book N-months ahead
• Proactive reminder of upcoming appointments
  – After Visit Summary
Scheduling Policy

• Rescheduling
  – Last-minute emergency

• Cancellation
  – Different reasons for cancellation
  – Capture cancellations without notification
    • *6% canceled via online portal (91/1,514)

• Withdrawal
Training

• On-site training before program implementation
• Documentation of scheduling process
• Regular site visits
Summary

• Implementable, independent solution package
• Collaborative effort from management to executions
• Consistent implementation
Ongoing work

• Incorporate uncertainty in model
• Refine policy for handling uncertainty
• Provide training to schedulers at sites
• Create adaptive solution packages
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