



Improving Access to an Outpatient Endocrinology Clinic

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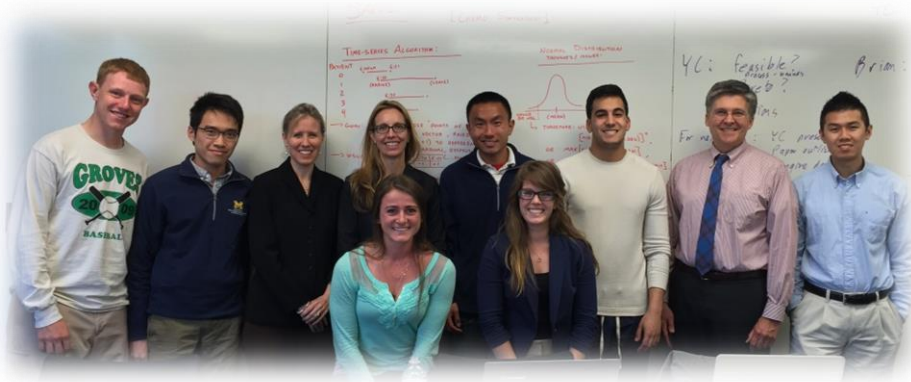
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Background

- 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

Before Program	Week of Program (100 Weeks Total)								
	1	2	3	4	5	6	7	8	...
New Patient (MD)	RD	RD	RD	RD				RD	
			MD					MD	

Challenges of Scheduling

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



Retrieved from <http://classroomtogo.blogspot.com/2012/07/prefixes-over.html>



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

Week	1	2	3	4	5	6	7	8	9	10	11	12
8:00 AM		RD	RD	RD	RD				RD			
8:15 AM	NP	RD	RD	RD	RD				RD			
8:30 AM	(MD)		RD	MD RD	RD	RD			MD	RD		
8:45 AM		NP			RD	RD						
9:00 AM		(MD)		RD	MD RD	RD	RD			MD	RD	
9:15 AM			NP									
9:30 AM		RD	(MD) RD	RD	RD	MD			RD		MD	
9:45 AM	NP											
10:00 AM	(MD)		RD	MD RD	RD	RD			MD	RD		
10:15 AM		NP										
10:30 AM		(MD)		RD	MD RD	RD	RD			MD	RD	
10:45 AM			NP									
11:00 AM			(MD)			MD					MD	
11:15 AM												



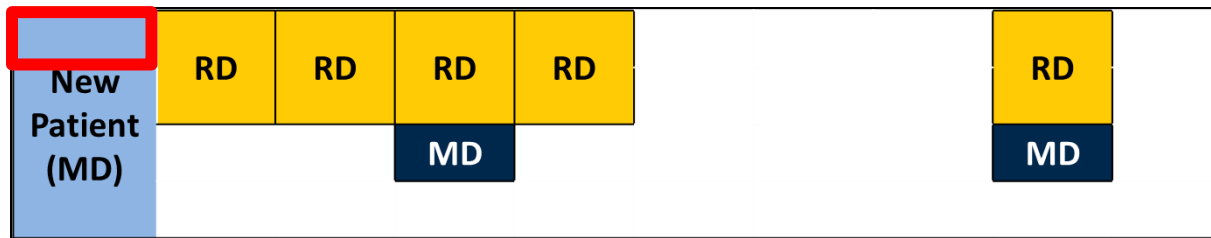
Model Parameters

W	number of weeks in horizon
D	number of days in a week
S	number of slots in a day
L	length of program, in weeks
P	number of patients to be scheduled

Model Parameters

$$\delta_{w_s d_s s_s w_c d_c s_c}^M, \delta_{w_s d_s s_s w_c d_c s_c}^R$$

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



$$c_{w_c d_c s_c}^M, c_{w_c d_c s_c}^R$$

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

$$\sum_{w_s=1}^{w_c} \sum_{d_s=1}^{d_c} \sum_{s_s=1}^{s_c} \delta_{w_s d_s s_s}^{M/R} x_{w_s d_s s_s} \leq C_{w_c d_c s_c}^{M/R}$$

$$w_c \in \{1..W\}$$

$$d_c \in \{1..D\}$$

$$s_c \in \{1..S\}$$

(2)

Model Objective Function

Start all patients as soon as possible

$$\mathbf{min} \quad z$$

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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THANK YOU!

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