

Boston Medical Center, Boston, MA

Clinic staff and providers experience **high variability and unpredictability** in their schedules. It is hypothesized that the **patient no-show rate** is increasing the unpredictability and variability and negatively impacting the patient and provider experience.

Literature Review	Understanding BMC	Data Analysis	Recommendations
<ul style="list-style-type: none"> Internal and external factors contribute to no-show rate Double booking, block scheduling and pooling of patients are strategies used to address no-shows "Open access" scheduling, reduced lead times and patient education can lower no-show rate 	<ul style="list-style-type: none"> Conducted interviews and shadowed BMC staff Limited data and inconsistent definitions across practices Limitations given the functionality of Epic and scheduling staff processes Previous MIT project recommendations were not implemented 	<ul style="list-style-type: none"> Variability of no-show rate and scheduling across practices and providers Opportunity to improve double-booking strategy (e.g., type and number of patients to double book) Increased lead time leads to increased no-show rate (particularly with NEW patients) 	<ul style="list-style-type: none"> Recommendation A: Updating scheduling templates to better align double-booking with a provider's patient no-show rate Recommendation B: Reducing appointment lead times for patients Recommendation C: Consistently and proactively managing patients who do not show for an appointment

Endocrinology

Recommendation A Deep Dive

1) Model that provides a "menu" of double-booking recommendations based on a provider's NEW and EST patient no-show rates:

NEW No Show Rate	EST No Show Rate																
	10%	12%	14%	16%	18%	20%	22%	24%	26%	28%	30%	32%	34%	36%	38%	40%	
10%	10	19	22	25	29	33	36	41	45	49	54	59	65	71	77	83	
12%	18	21	25	28	32	36	39	44	48	53	58	63	68	73	78	83	
14%	21	24	27	31	35	39	43	47	51	56	61	65	69	73	78	83	
16%	24	27	30	34	38	42	46	50	55	58	61	65	69	73	78	83	
18%	26	30	33	37	40	45	49	52	55	58	61	65	69	73	78	83	
20%	29	32	36	40	43	47	49	52	55	58	61	65	69	73	78	83	
22%	32	35	39	42	46	48	49	52	55	58	61	65	69	73	78	83	
24%	34	38	41	45	48	49	51	52	55	58	61	65	69	73	78	83	
26%	37	40	44	48	49	51	52	53	55	58	61	65	69	73	78	83	
28%	40	43	47	50	51	52	53	55	56	58	61	65	69	73	78	83	
30%	42	46	50	51	52	54	55	56	58	60	61	65	69	73	78	83	
32%	45	49	51	53	54	55	57	58	60	61	63	65	69	73	78	83	
34%	48	51	53	54	55	57	58	60	61	63	65	67	69	71	73	78	83
36%	50	53	55	56	57	59	60	62	63	65	67	69	71	73	78	83	
38%	53	55	56	58	59	60	62	64	65	67	69	71	73	76	78	83	
40%	56	57	58	60	61	63	64	66	68	69	71	74	76	78	81	83	
42%	57	59	60	62	63	65	66	68	70	72	74	76	78	81	83	86	
44%	60	61	62	64	65	67	69	70	72	74	77	79	81	84	86	89	
46%	62	63	65	66	68	69	71	73	75	77	79	82	84	87	90	93	
48%	64	66	67	69	70	72	74	76	78	80	82	85	87	90	93	96	
50%	67	68	70	71	73	75	77	79	81	83	86	88	91	94	97	100	

Method: find the optimal amount of time to be double-booked (during a 4-hour session) rather than explicit schedule

Optimization Model:

Parameters: no-show rate for new and established patients

Decision variables: 1) amount of time to be double-booked established over established and 2) amount of time to be double booked new over established

Objective: minimize idle time

Constraints: 1) expected total congested time (i.e. time where two patients need to be seen, and both show up) is less than 30 minutes, 2) expected idle time is at least 10 minutes and 3) session has 2 new patients, each scheduled for 40 minutes.

- Do not Double-book
- Double-book 20 minutes
- Double-book 40 minutes
- Double-book 60 minutes
- Double-book 80 minutes
- Double-book 100 minutes

2) Sample template change based on provider specific patient no-show rates:

Friday Morning Current State:

EST Patient No-Show Rate: **30%**
NEW Patient No-Show Rate: **35%**

Monday AM	
8:20am	EST
8:40am	EST
9:00am	NEW
9:20am	
9:40am	EST
10:00am	EST
10:20am	NEW
10:40am	
11:00am	EST
11:20am	EST
11:40am	EST
12:00pm	UTL
12:20pm	END

Recommended Schedule:

EST/EST Double-booking: **0 mins**
NEW/EST Double-booking: **40 mins**

Monday AM	
8:20am	
8:40am	NEW
9:00am	EST
9:20am	
9:40am	NEW
10:00am	EST
10:20am	
10:40am	EST
11:00am	NEW
11:20am	
11:40am	EST
12:00pm	UTL
12:20pm	END

Current State (historic data 2017-2018):

Average Number of Patients Seen per Session: **6.29**
Average Idle Time (from historic data): **76 mins**
Average Overtime: **Unknown**
Patient Wait Time: **Unknown**
Maximum Patient Wait Time: **Unknown**

Simulation Results:

Expected Number of Patients Seen per Session: **7.5**
Expected Idle Time: **39 mins**
Expected Overtime: **19 mins**
Expected Average Patient Wait Time: **7 mins**
Expected Maximum Patient Wait Time: **17 mins**

Recommendation C Overview

- Proactively manage patients who do not show for appointments
- Potential recommendations include: maintaining a no-show list, standardizing communication with patients following no-show, and "open-access" appointments or "no-show clinic" for identified patients
- Create consistent patient touch points with a variety of stakeholders (call-center/schedulers, providers, practice managers)

Key Takeaways, Limitations and Considerations

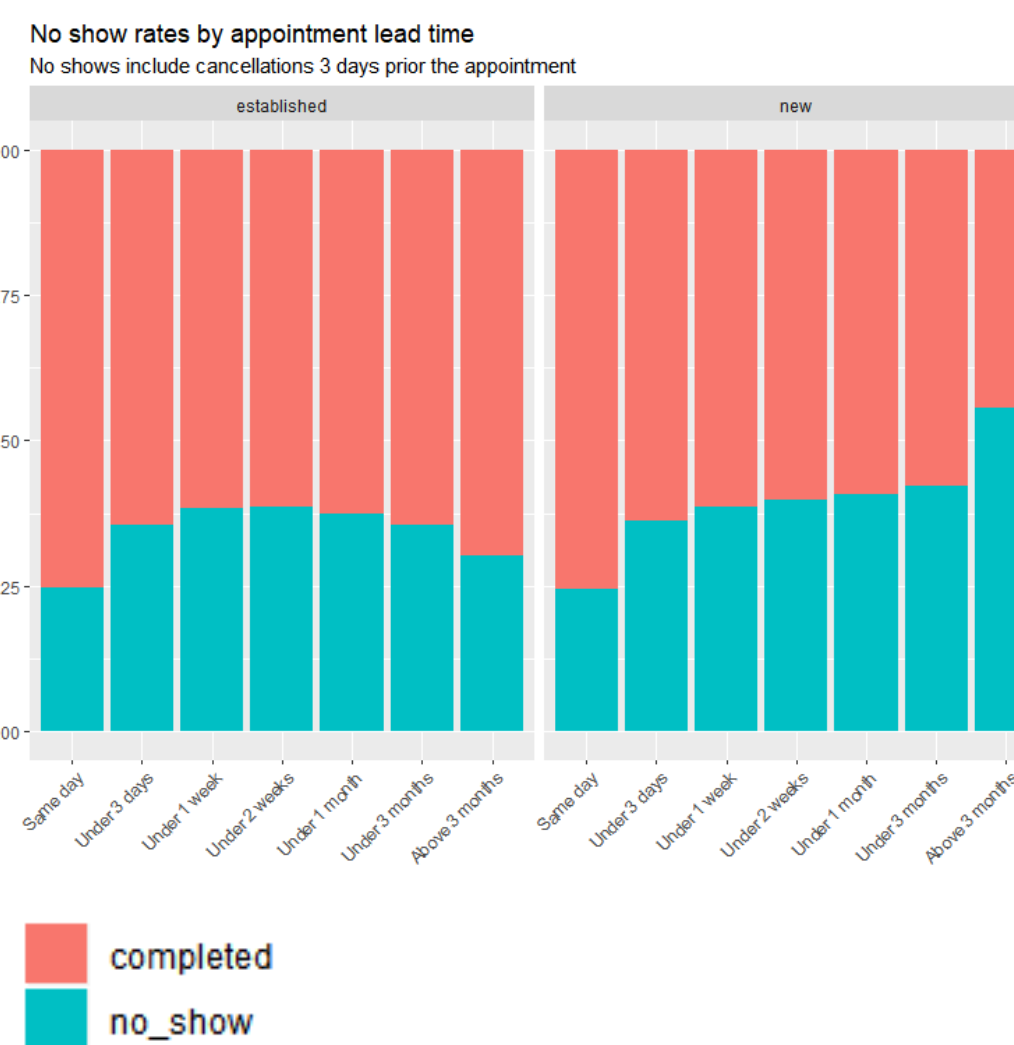
There are multiple approaches to reducing no-show rate & recommendations may vary by department (or should be adjusted) depending on procedures and appointment characteristics. Limitations with the recommendations exist based on data metrics and a need for a consistent definition for a successful session at BMC.

General Internal Medicine

Recommendation B Deep Dive

1) Understand current no-show rates based on appointment lead time and reasoning for pattern in EST patient no-show rate:

	Same day	< 3 days	< 1 week	< 2 weeks	< 1 month	< 3 months	> 3 months
EST	25%	35%	38%	39%	37%	35%	30%
New	24%	36%	39%	40%	41%	42%	56%



- As lead times increase the no-show rate for NEW patients increases
- When lead time is under a month, behavior across NEW and EST patients is similar
- Expected that EST patients booked more than 3 months out are booked due to **need** and NEW patients are booked based on **availability** - thus the increase in no-show rate for NEW patients is more dramatic

2) Understand necessary lead times to lower average no-show rate for a provider to allow for booking 11 patients to see 9

Est no-show rate	New no-show rate																						
	0.1	0.12	0.14	0.16	0.18	0.2	0.22	0.24	0.26	0.28	0.3	0.32	0.34	0.36	0.38	0.4	0.42	0.44	0.46	0.48	0.5		
0.1	9.9	9.86	9.82	9.78	9.74	9.7	9.66	9.62	9.58	9.54	9.5	9.46	9.42	9.38	9.34	9.3	9.26	9.22	9.18	9.14	9.1		
0.12	9.72	9.68	9.64	9.6	9.56	9.52	9.48	9.44	9.4	9.36	9.32	9.28	9.24	9.2	9.16	9.12	9.08	9.04	9	8.96	8.92		
0.14	9.54	9.5	9.46	9.42	9.38	9.34	9.3	9.26	9.22	9.18	9.14	9.1	9.06	9.02	8.98	8.94	8.9	8.86	8.82	8.78	8.74		
0.16	9.36	9.32	9.28	9.24	9.2	9.16	9.12	9.08	9.04	9	8.96	8.92	8.88	8.84	8.8	8.76	8.72	8.68	8.64	8.6	8.56		
0.18	9.18	9.14	9.1	9.06	9.02	8.98	8.94	8.9	8.86	8.82	8.78	8.74	8.7	8.66	8.62	8.58	8.54	8.5	8.46	8.42	8.38		
0.2	9	8.96	8.92	8.88	8.84	8.8	8.76	8.72	8.68	8.64	8.6	8.56	8.52	8.48	8.44	8.4	8.36	8.32	8.28	8.24	8.2		
0.22	8.82	8.78	8.74	8.7	8.66	8.62	8.58	8.54	8.5	8.46	8.42	8.38	8.34	8.3	8.26	8.22	8.18	8.14	8.1	8.06	8.02		
0.24	8.64	8.6	8.56	8.52	8.48	8.44	8.4	8.36	8.32	8.28	8.24	8.2	8.16	8.12	8.08	8.04	8	7.96	7.92	7.88	7.84		
0.26	8.46	8.42	8.38	8.34	8.3	8.26	8.22	8.18	8.14	8.1	8.06	8.02	7.98	7.94	7.9	7.86	7.82	7.78	7.74	7.7	7.66		
0.28	8.28	8.24	8.2	8.16	8.12	8.08	8.04	8	7.96	7.92	7.88	7.84	7.8	7.76	7.72	7.68	7.64	7.6	7.56	7.52	7.48		
0.3	8.1	8.06	8.02	7.98	7.94	7.9	7.86	7.82	7.78	7.74	7.7	7.66	7.62	7.58	7.54	7.5	7.46	7.42	7.38	7.34	7.3		
0.32	7.92	7.88	7.84	7.8	7.76	7.72	7.68	7.64	7.6	7.56	7.52	7.48	7.44	7.4	7.36	7.32	7.28	7.24	7.2	7.16	7.12		
0.34	7.74	7.7	7.66	7.62	7.58	7.54	7.5	7.46	7.42	7.38	7.34	7.3	7.26	7.22	7.18	7.14	7.1	7.06	7.02	6.98	6.94		
0.36	7.56	7.52	7.48	7.44	7.4	7.36	7.32	7.28	7.24	7.2	7.16	7.12	7.08	7.04	7	6.96	6.92	6.88	6.84	6.8	6.76		
0.38	7.38	7.34	7.3	7.26	7.22	7.18	7.14	7.1	7.06	7.02	6.98	6.94	6.9	6.86	6.82	6.78	6.74	6.7	6.66	6.62	6.58		
0.4	7.2	7.16	7.12	7.08	7.04	7	6.96	6.92	6.88	6.84	6.8	6.76	6.72	6.68	6.64	6.6	6.56	6.52	6.48	6.44	6.4		

This table shows the expected number of patients to show given a provider's patient no-show rates and a schedule that books 9 EST and 2 NEW patients

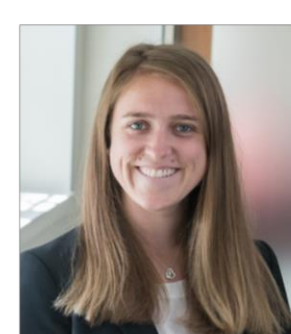
Conclusions:

- Orange square is range of possible no-show rates attained by decreasing lead time
- Given the current state, it does not appear possible (on average) to book 11 patients and have 9 patients expected to show
- Consider decreasing lead times to decrease the no-show rate – recommendation to not book NEW patients more than 3 months out
- Educate patients on the importance of showing up and establish a consistent way of handling no-shows

Opportunity exists to standardize communication & processes once patients no-show

- Determine appetite for intervention post no-show**
- Develop consistent communication & processes for no-shows**
- Determine scheduling strategy for no-shows**
- Evaluate no show rate & impact**

Healthcare Lab 2018 Student Team



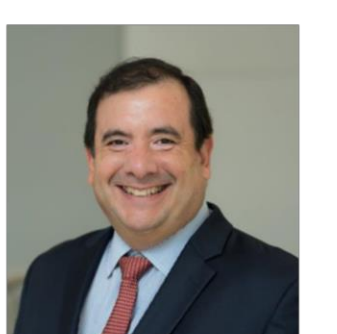
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