LeanTaaS

Memorial Sloan Kettering Cancer Center

Optimizing Operations to Create the Intelligent Oncology Center of the Future

Mohan Giridharadas, Jen Tota

Agenda for Today's Presentation

1	**Creating the Intelligent Oncology Center of the Future**	**Mohan Giridharadas** Founder & CEO, LeanTaaS
2	**Sharing the MSKCC Case: Optimizing Infusion Centers**	**Jen Tota** Director, Ambulatory Care Memorial Sloan Kettering Cancer Center

Overview

LeanTaaS is a Silicon Valley software company focused on:

Operational Excellence for Health Systems through Predictive Analytics

Commercially Available iQueue Products

Infusion

- **Successfully deployed at ~85 infusion centers (2,200 chairs) including 15 of the top 30 cancer hospitals in the United States**

Operating Rooms

- **Successfully deployed at ~250 Operating Rooms across 8 health systems in the United States**

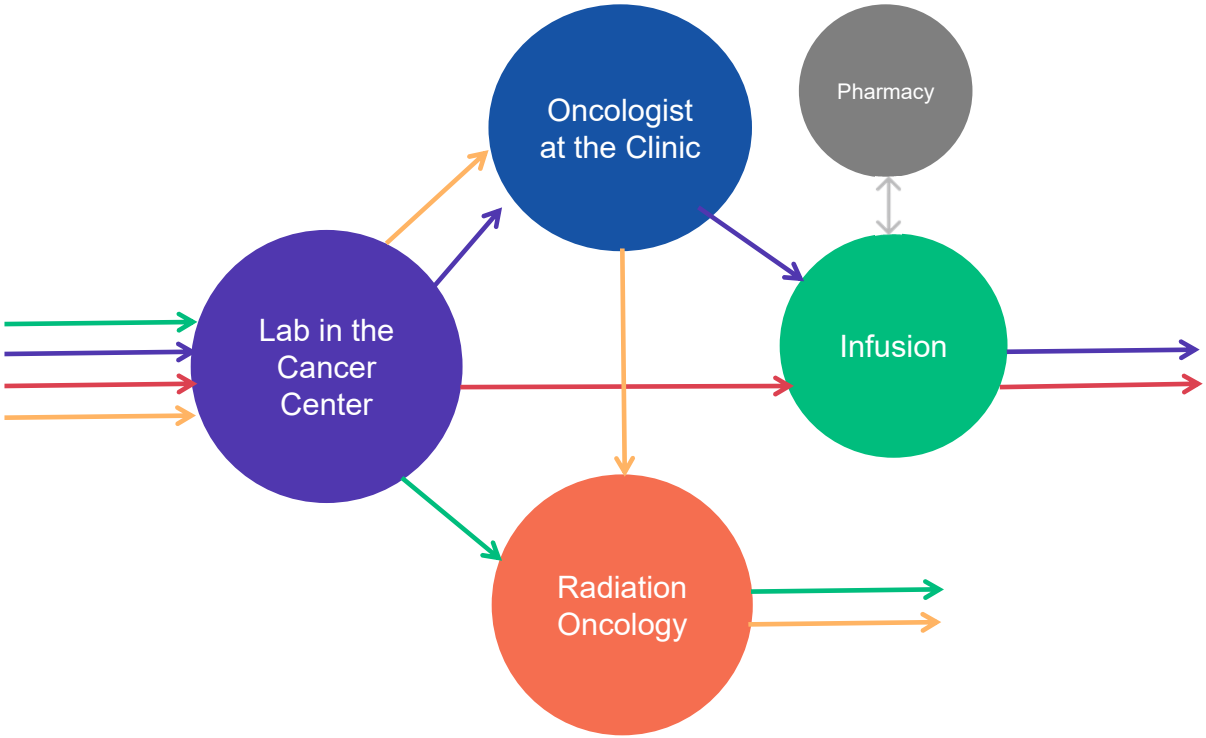
Under active development

Oncology Clinics

- **Launched simultaneous pilots with Memorial Sloan Kettering and MD Anderson in January 2018**

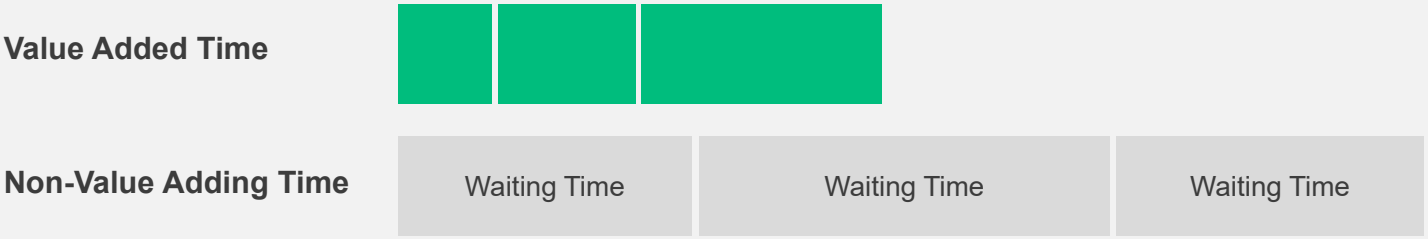
Cancer Centers Face 3 Operational Challenges | 1 of 3

Each patient has a unique journey through the Cancer Center



Cancer Centers Face 3 Operational Challenges | 2 of 3

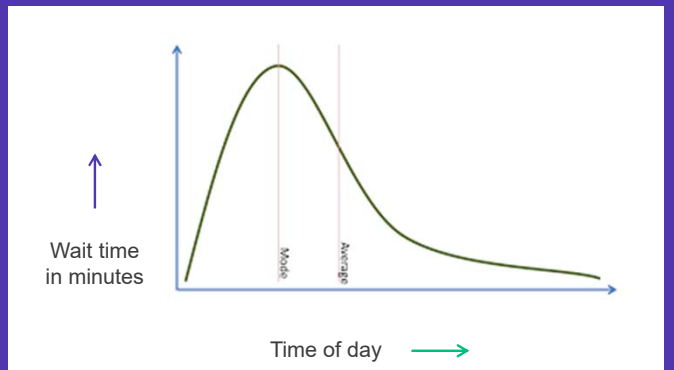
Each patient is forced to wait at each step of the journey



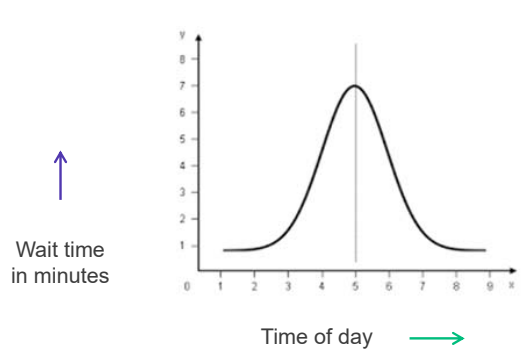
Cancer Centers Face 3 Operational Challenges | 3 of 3

Many steps have a “rush hour” effect making the wait even longer...
...and creating a “domino effect” for other patients

Labs peak in the morning



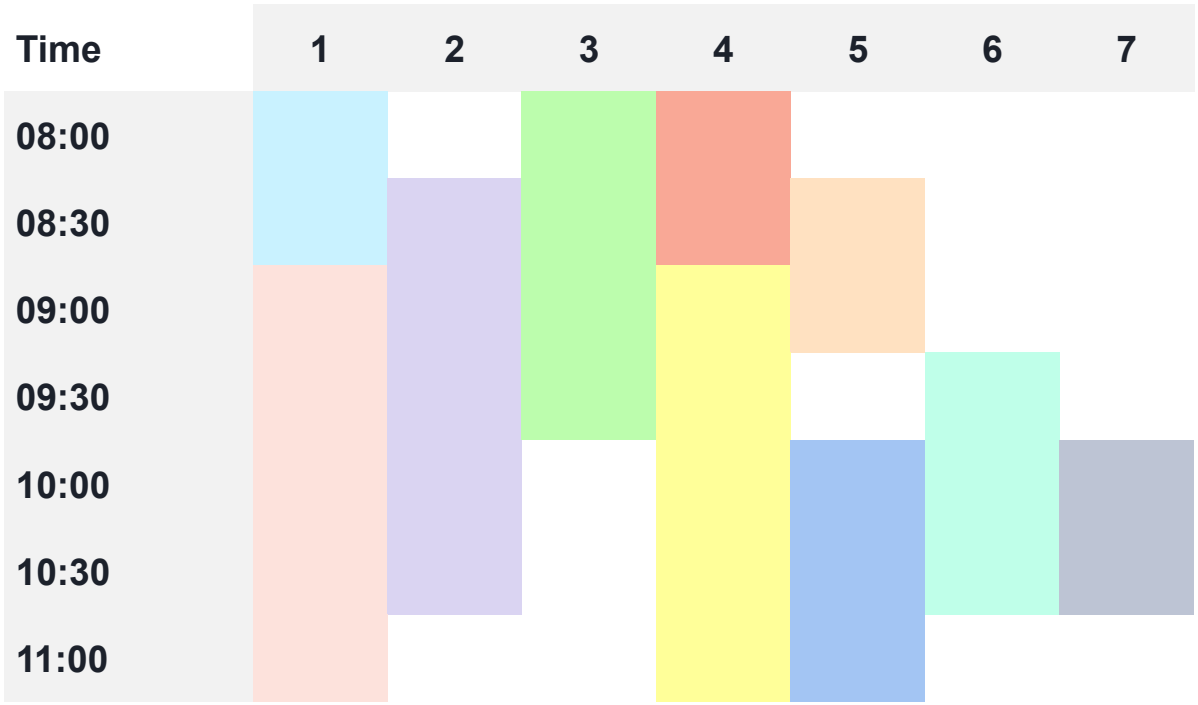
Infusion peaks at mid-day



Scheduling in Health Systems is built on an extremely weak mathematical foundation (1 of 5)

Grid-based scheduling DOES NOT WORK for healthcare

"Resource" – Provider/Room/Machine/Chair

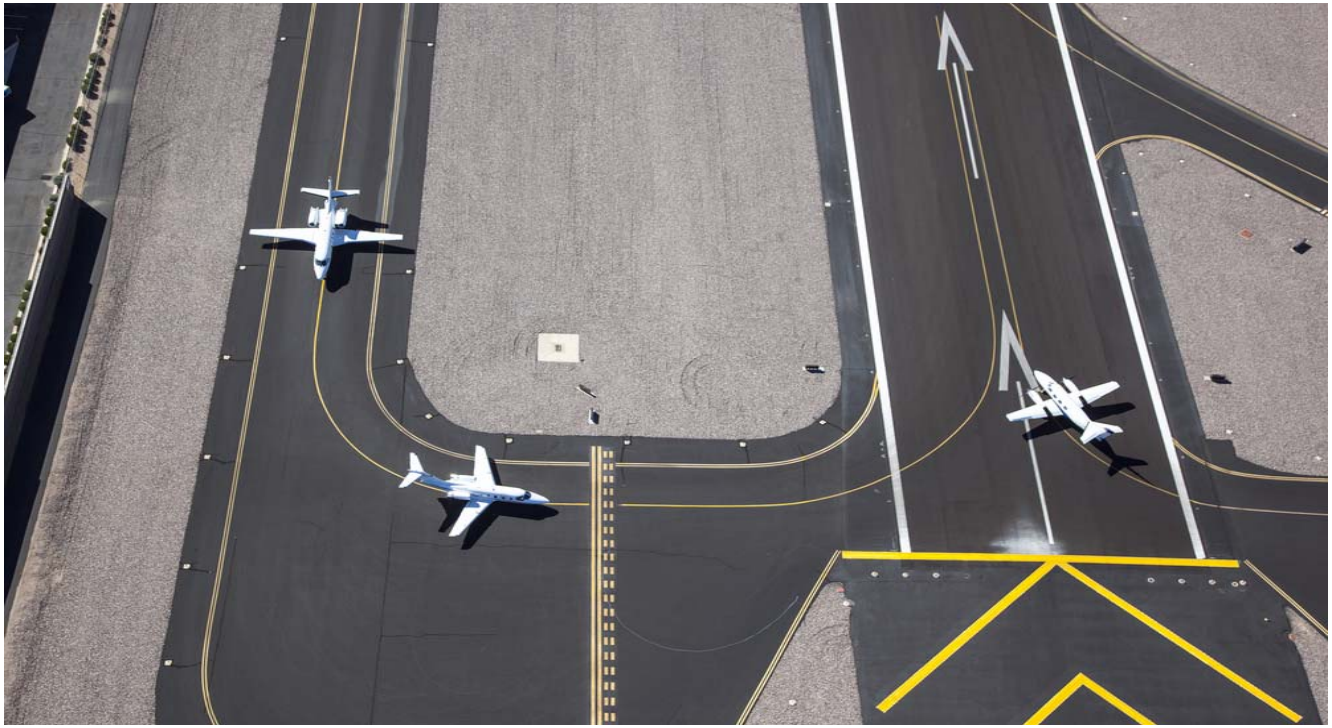


Scheduling in Health Systems is built on an extremely weak mathematical foundation (2 of 5)

EHR based scheduling **does not use probability theory** to plan for overbooks, cancellations and add-ons

Scheduling in Health Systems is built on an extremely weak mathematical foundation (3 of 5)

Linked appointments are like connecting flights – they only work if the on-time performance of each flight is ~90%



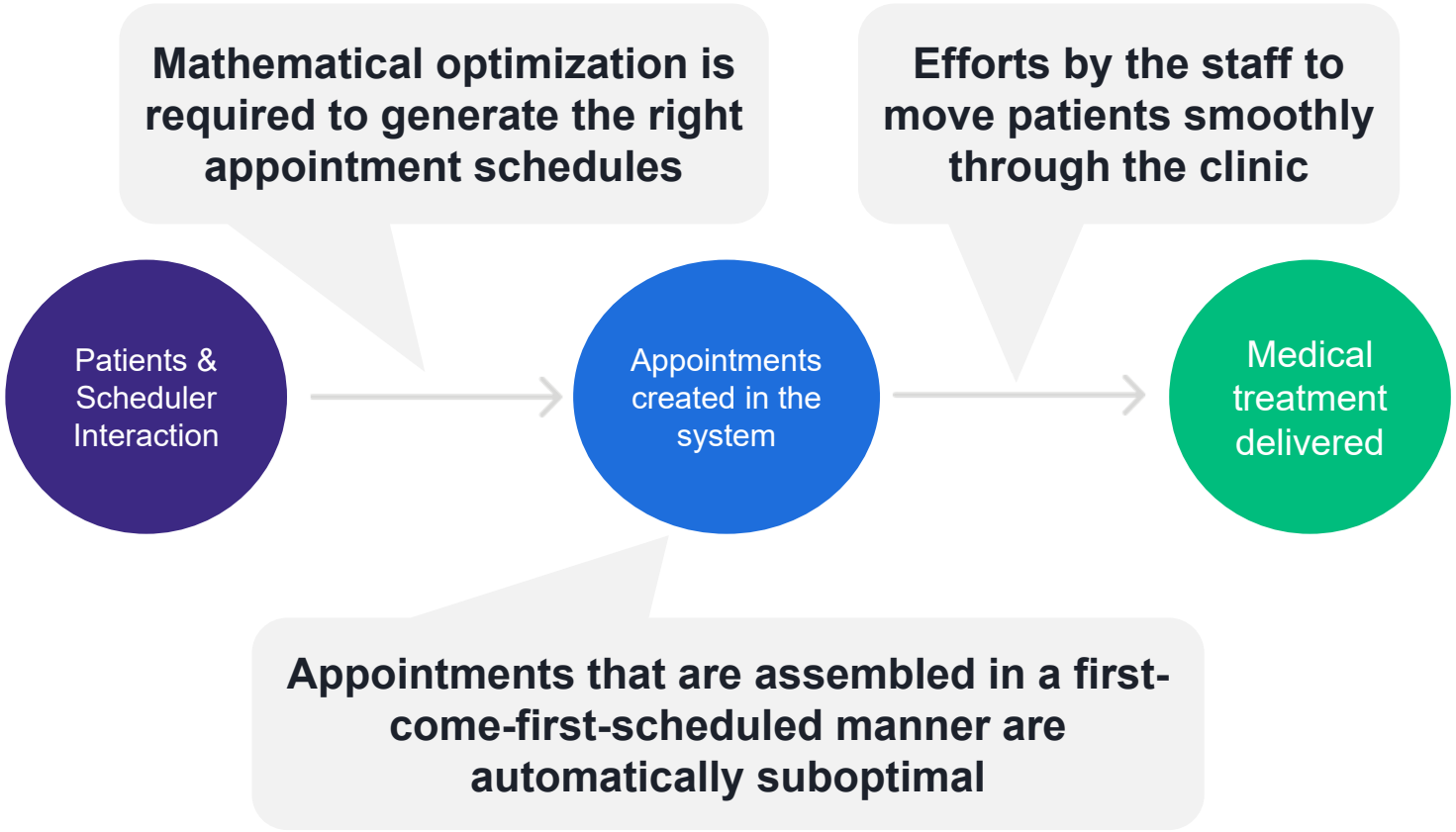
Scheduling in Health Systems is built on an extremely weak mathematical foundation (4 of 5)

First-come-first-scheduled is the INCORRECT APPROACH for medical appointments

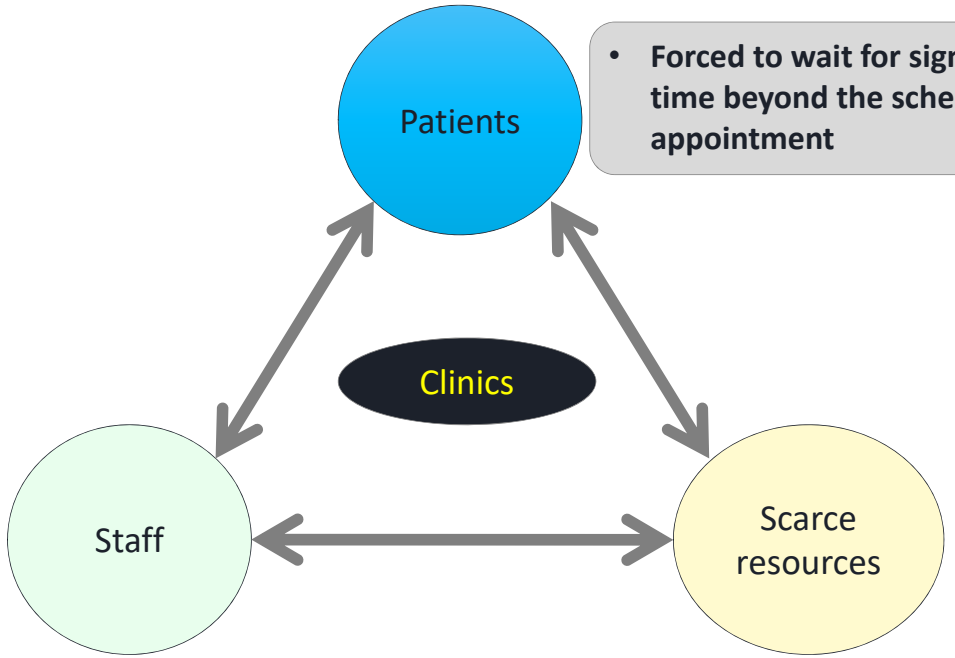
Scheduling in Health Systems is built on an extremely weak mathematical foundation (5 of 5)

Assigning fixed resources (rooms, chairs) is the natural reaction of providers/clinics – but it DOES NOT WORK

Operational performance is heavily dependent on whether optimal schedules have been built



The impact of the weak mathematical foundation is felt in the day-to-day operational reality

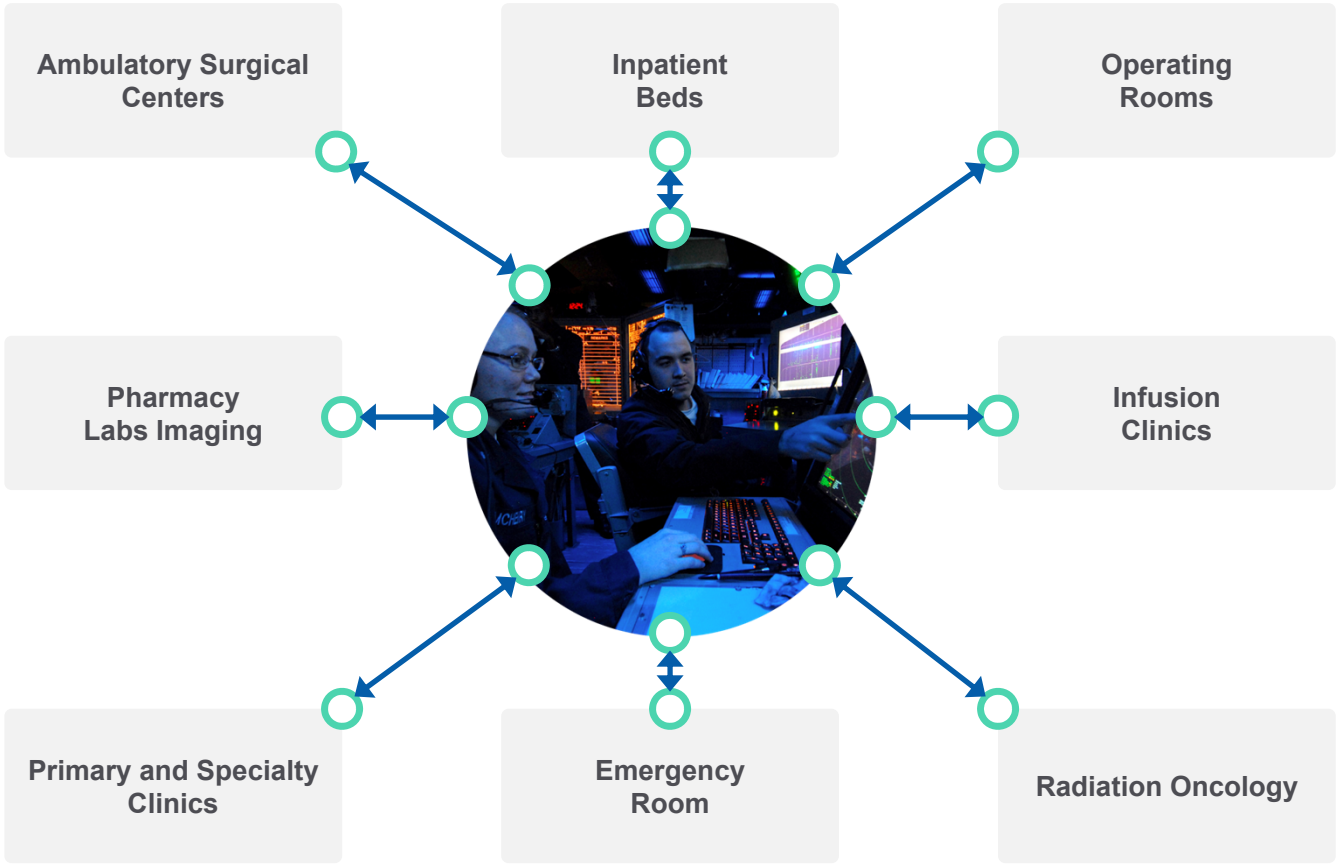


- **Forced to wait for significant amounts of time beyond the scheduled start of the appointment**

- **Forced to scramble on a continuous basis in order to accommodate patients for the current day**

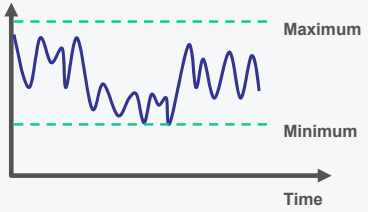
- **Resources are both over-utilized and idle at different points during the day even while patients are in the waiting room**

Unlock capacity in the “nodes” before attempting to optimize the “edges”



Synchronize the demand pattern with the available supply

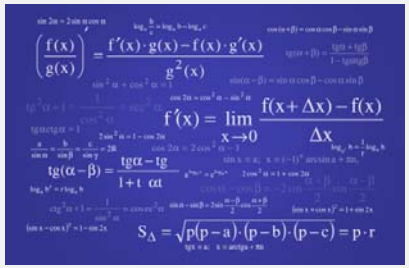
Demand



Forecast the daily demand volume, mix and timing based on historical demand data

Level loaded demand profile that optimizes the type and sequence of appointments

Data Science Algorithms



Sophisticated Forecasting Models

Resource rules and constraints

Optimization engine to synchronize demand and supply

Supply

Analyze the resource (people and assets) utilization patterns

Optimal staff ramp-up schedule and asset allocation model

Build Deep Data Science Skills to Accelerate Impact

1. PREDICT

Predict demand patterns (volume, mix, timing) using sophisticated mathematical and geometric models

2. OPTIMIZE

Generate optimal templates through lean principles and constraint-based optimization algorithms that flatten the workload

3. SIMULATE

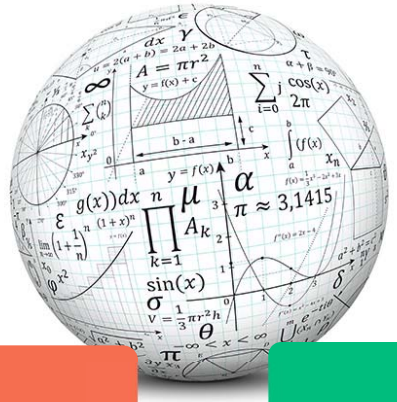
Validate the resilience of the templates to the inevitable variances that will occur

4. DEPLOY

Translate the optimal templates into appointment slots that are monitored daily

5. LEARN

Use machine learning to tweak the coefficients of the forecasting models in order to continuously improve the accuracy of the forecasts



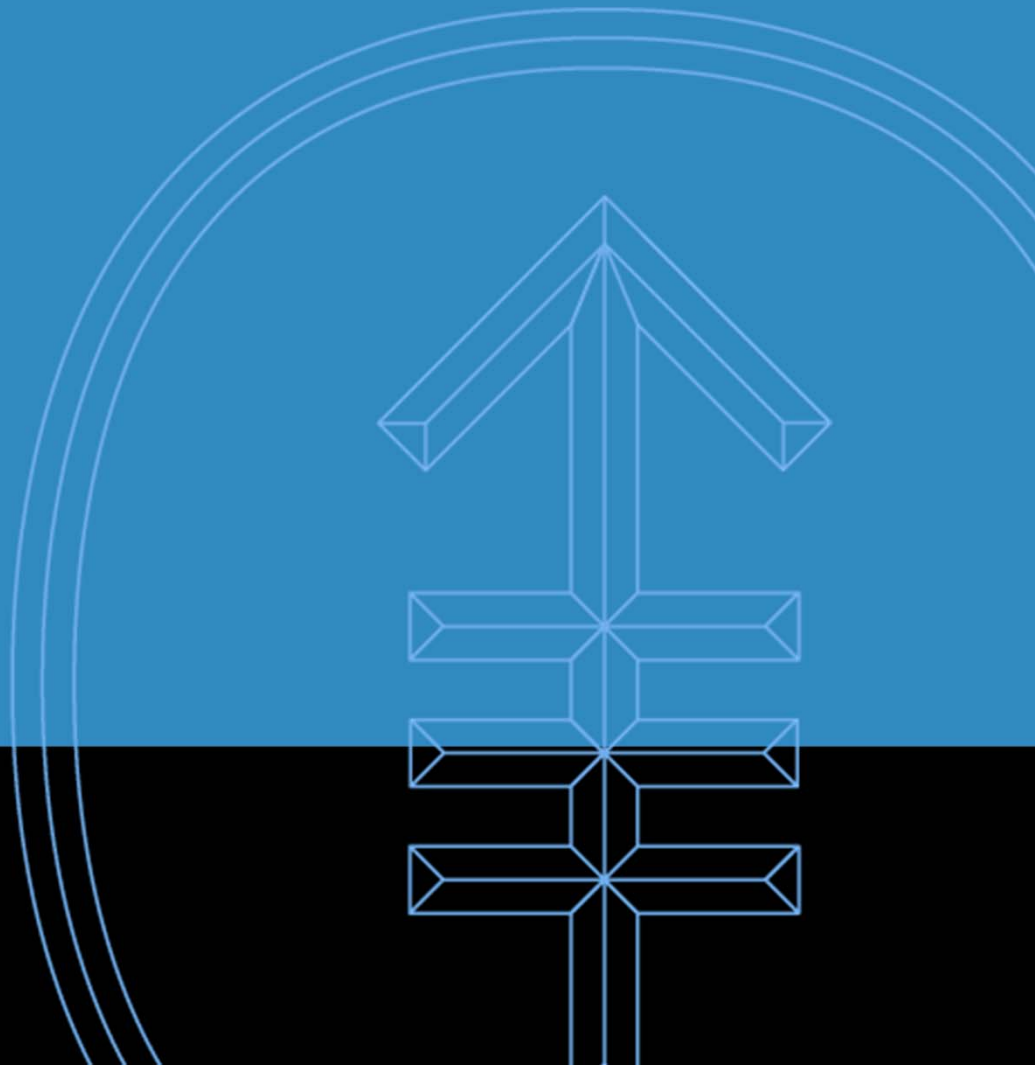
OPERATING ROOMS | INPATIENT BEDS | CLINICS | INFUSION CENTERS

Agenda for Today's Presentation

1	**Pursuing Operational Excellence in Cancer Care**	**Mohan Giridharadas** Founder & CEO, LeanTaaS
→ 2	**Sharing the MSKCC Case: Optimizing Infusion Centers**	**Jen Tota** Director, Ambulatory Care Memorial Sloan Kettering Cancer Center

Memorial Sloan Kettering Cancer Center

The MSK Infusion Experience



Infusion at MSK by the numbers

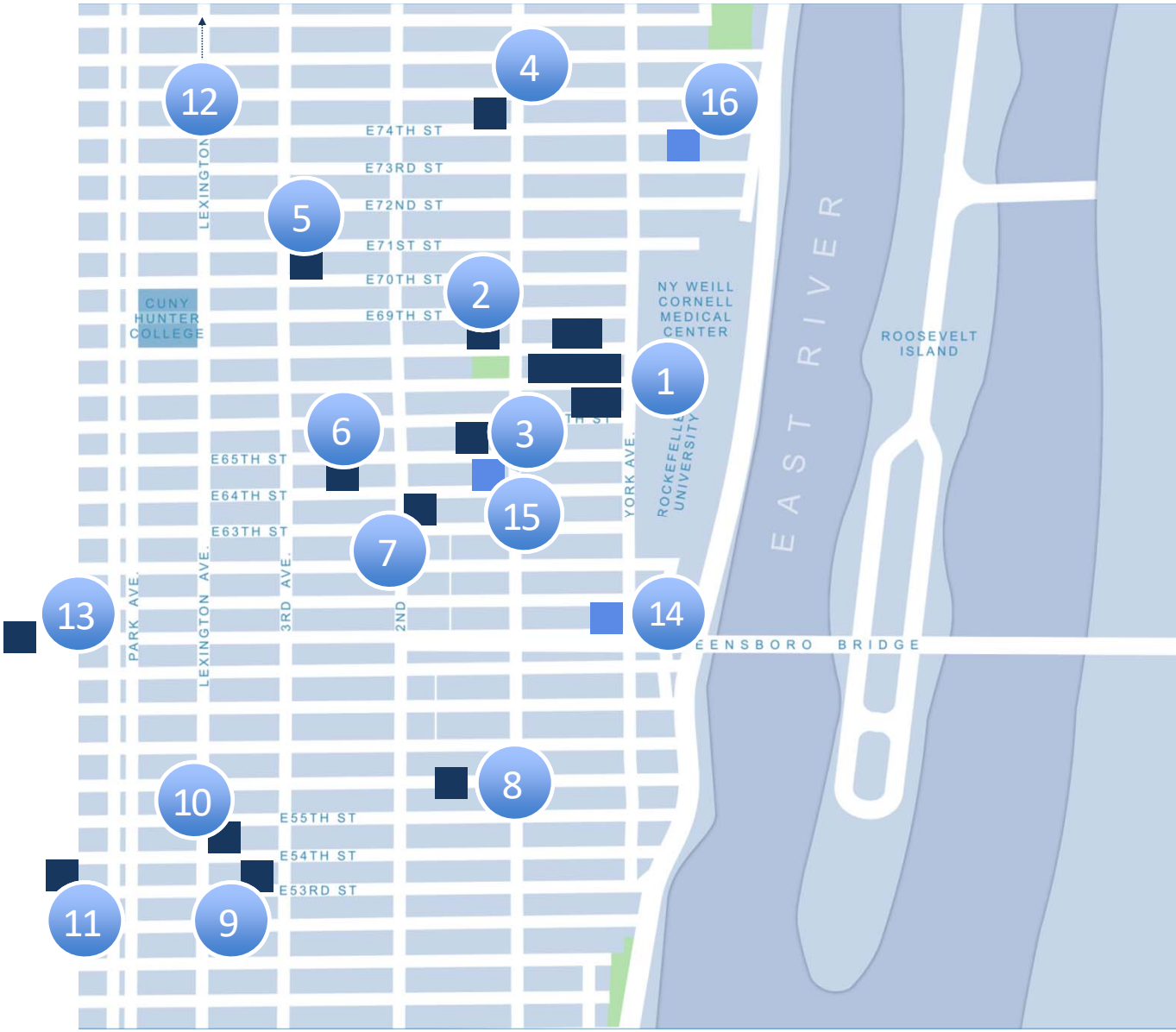
247,496 Visits

302 Chairs

NYC and Suburban Sites

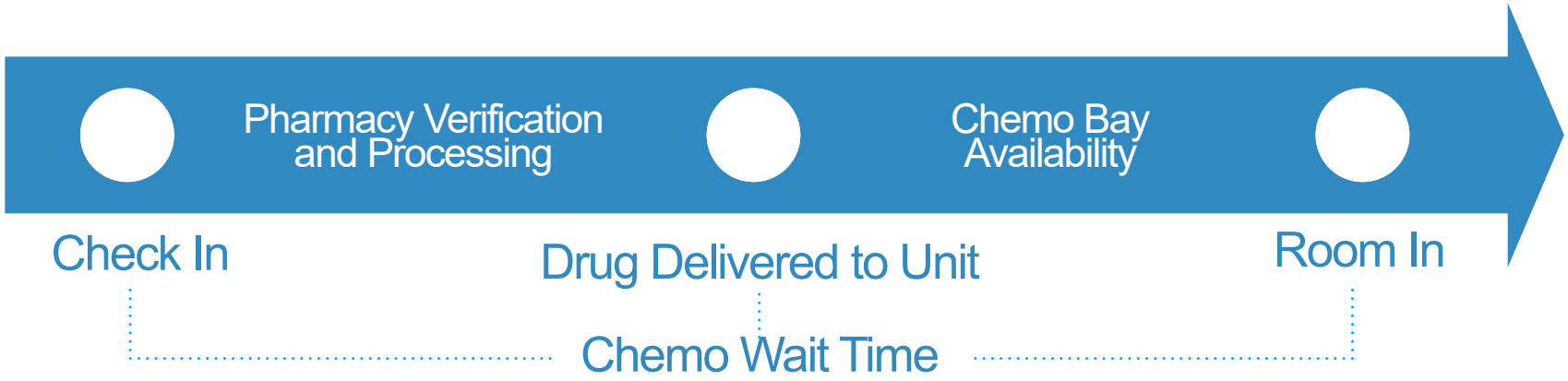
MSK New York City Locations

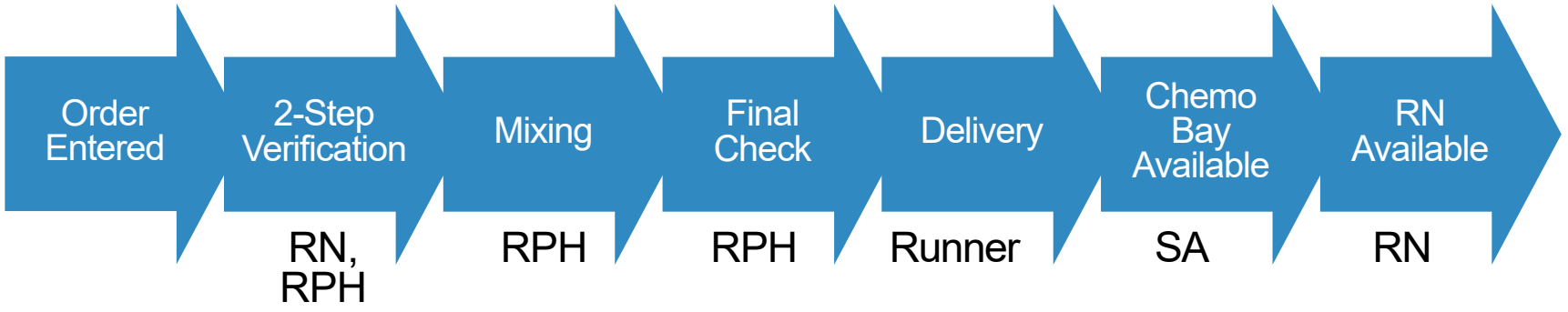
1. Main Campus
2. Sidney Kimmel Center for Prostate and Urologic Cancers
3. Evelyn H. Lauder Breast Center and MSKCC Imaging Center
4. Bendheim Integrative Medicine Center
5. Employee Health Services
6. 64th Street Outpatient Center
7. Epidemiology and Biostatistics
8. 301 E 55th St. Imaging Center
9. Rockefeller Outpatient Pavilion
10. Counseling Center, Psychiatry
11. Sillerman Center for Rehabilitation
12. Breast Examination Center of Harlem
13. 60th St. Outpatient Center
14. Josie Robertson Surgical Center
15. 64th St. Laboratory Building
16. 74th St. Outpatient Facility (2019)



MSK Suburban Locations Outside Manhattan

Chemotherapy Operational Process[MD]

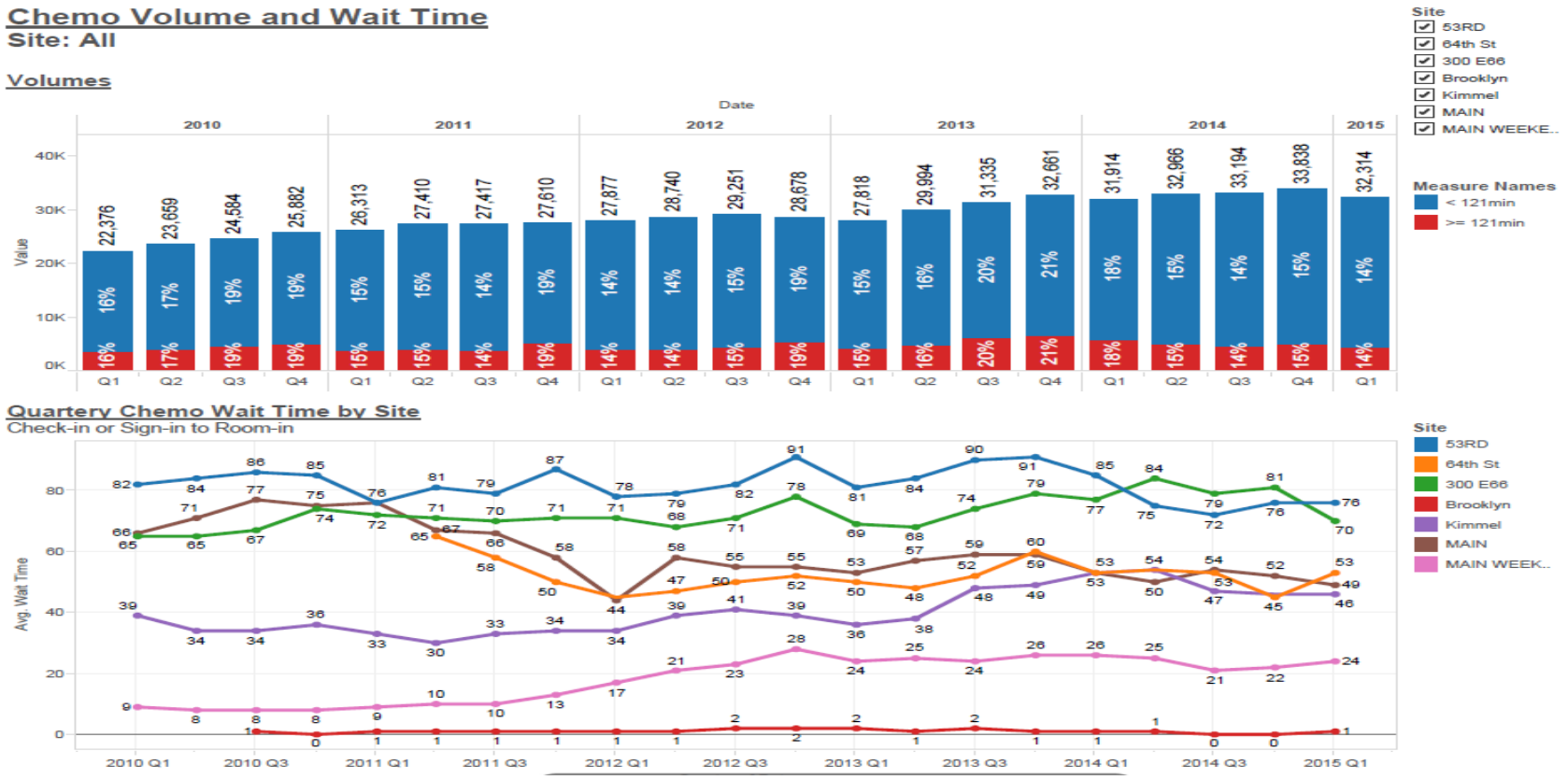




Memorial Sloan Kettering Cancer Center

Historical Infusion Process Improvement Initiatives

Historical Infusion Wait Time Data



2005-2009: Chemotherapy Process Improvement Initiatives

2005

- Chemo flow simulations

2006

- IDEO: Day before bloods, fast tracking, chemo ready
- Patient Journey model
- Reserving resources (dedicated chairs)
- Smooth Scheduling

2007

- Patient Resource Advisor
- Holiday Chemo opening
- Quest Interface

2008

- Low cost delivery model (BIC)
- Zero wait time for chemo

2009

- Value Stream Mapping
- Parsons design prototypes
- Saturday Main chemo opening

2010-2014: Chemotherapy Process Improvement Initiatives

2010

- » Clean Room
- » Status Board Implementation
- » Sunday Main chemo opening
- » Pharmacy processing with pending lab results
- » MD in Chemo

2011

- » Advanced orders review with MDs
- » Infusion Tracking at 53rd
- » Chemo info SA
- » Early Drug processing for uncoordinated chemo

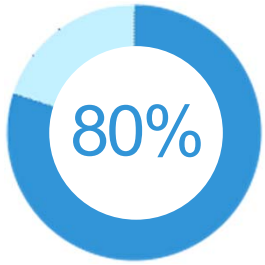
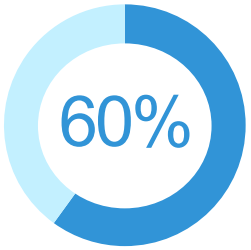
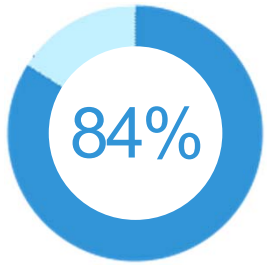
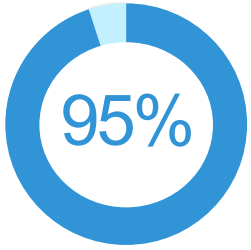
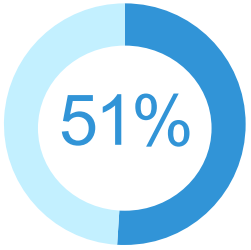
2012

- » Infusion Tracking at BAIC
- » Advanced chemo processing (2 hrs prior to appt time)

2014

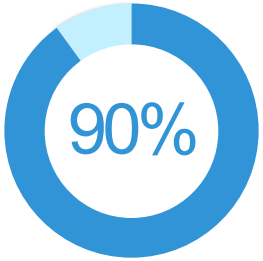
- » Adherence to appt times
- » Incremental RPH Shifts
- » Verification RN
- » Plasma
- » Protocol Advanced Orders
- » 6PM Advanced Orders Commitment

2015 Goals: Rockefeller Outpatient Center

	Advanced Orders	Verification of Advanced Orders	Premixing
Goals			
	By 6PM prior day	By midnight (conventional)	Drug delivered on unit prior to patient arrival
Outcomes			

2016 Goals: Outpatient Chemotherapy

Advanced Orders

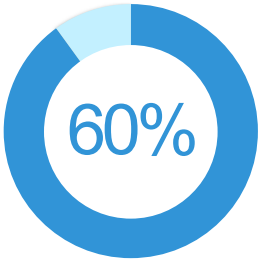


By 6PM prior day

Verification of Advanced Orders

By midnight (conventional)

Premixing



Drug delivered on unit prior to patient arrival

Wait Times

"15 IN 16"

15 min from Appointment Time (conventional, premix or advanced)


Memorial Sloan Kettering
Cancer Center
The MSK
Infusion
Experience
Enhanced by iQueue

Starting Small at MSK

60,000 Infusion Visits

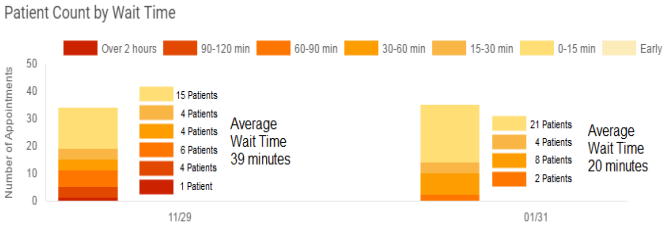
5 Infusion Units

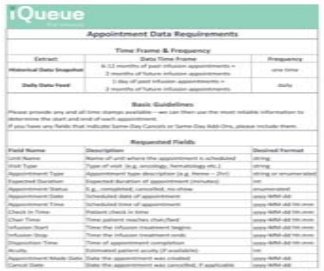
76 Treatment Spaces

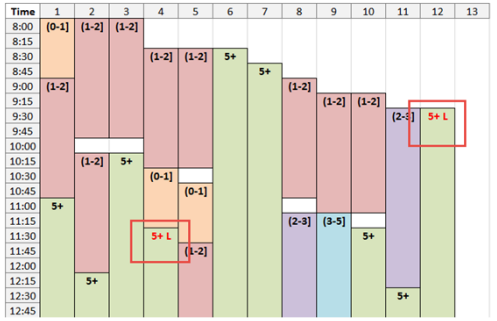
250-300 Daily Visits

1st iQueue Pilot: 1 Unit, 13 Chairs

How does iQueue for Infusion Work?







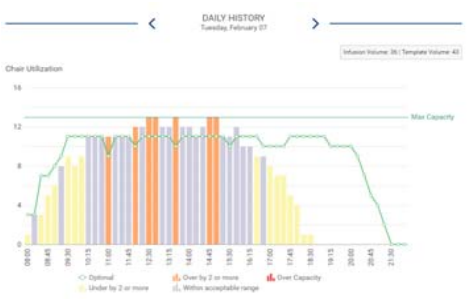
Data Mining of Retrospective Data

Optimal Infusion Template

Prospective Unit Utilization Reports

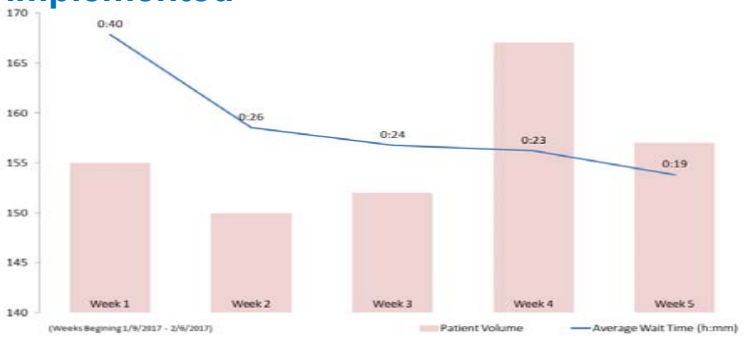
Retrospective Unit Utilization Reports

Wait Time and Unit Performance Reporting

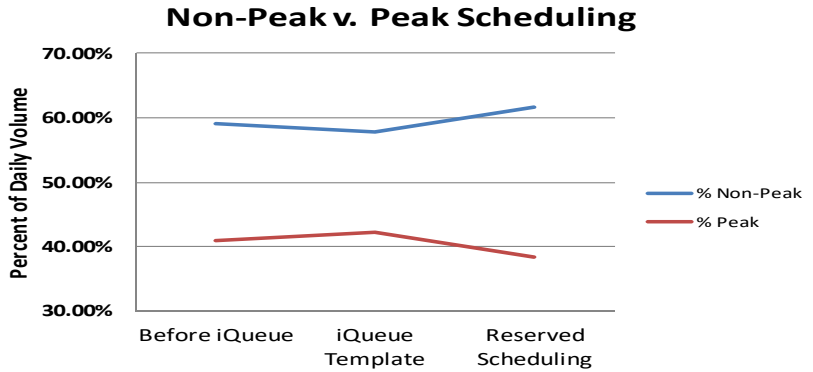


Early Success

Average Wait Times decreased once performance tools and revised scheduling model were implemented



Improved non-peak scheduling once performance tools and our revised scheduling practice were in effect



Improved Utilization of Unit Resources

Where are we now?

iQueue Templates and Predictive Tools Implemented

126 Chairs
8 Infusion Units

Over 50% patients wait 15 minutes or less!

40% ⬇ in Overall Wait Times!

What's Next with the MSK/iQueue Work?

iQueue for Infusion Centers

Template and Predictive Tools

190 Incremental Chairs
9 Units

iQueue for Clinics

Templates and Predictive Tools

20 Outpatient Practices
Medical Oncology, Surgery

Memorial Sloan Kettering Cancer Center

The MSK Infusion Experience

THANK YOU!