Infusion Centers

5 steps to mastering the daily scramble for infusion chairs
After surveying the leadership teams of 500+ infusion centers over a five-year period, LeanTaaS found that facilities all over the country shared similar operational concerns. They often find themselves “playing Tetris” when trying to cobble together daily schedules for their infusion chairs.

Three common challenges are faced by virtually every single infusion center:

01 Patients tend to **wait a long time** for their infusion appointments—especially in the middle of the day.

02 Chair utilization starts out low and ends low, but has a **midday peak** during which chair demand is at or above maximum chair capacity virtually every weekday.

03 Infusion-center **nurses miss their lunch breaks** several times each week and often have high levels of overtime and emergency callbacks on their days off.

Scheduling should be as simple as reserving a chair for the patient for the duration of their treatment, much as one might reserve a tanning bed or make a spa appointment. Then why doesn’t it work out that way in practice?

On the surface, the scheduling of infusion treatments appears to be a fairly simple problem. Patients are scheduled in advance. The appropriate mix of medications for the specific treatment is prepared by the pharmacy. The patient is seated in an infusion chair and remains seated for a preset duration.
Balancing Supply and Demand

The foundation of all these challenges is the issue of supply and demand.

**Demand** for infusion is highly volatile. The volume of patients on any specific day in the future is highly variable. Infusion center staff don’t know how many patients will need to schedule appointments on any given future day.

There’s also the impact of cancellations, add-ons, and no-shows, and the mix of treatment durations for a given day.

This is the central issue of infusion-center scheduling that creates a Tetris-like challenge for schedulers. It creates a logistical challenge that is beyond the capacity of a normal human mind to solve.

On the **supply** side, the parameters are highly constrained. The number of chairs and the hours of operation are relatively static since they aren’t changed very often. The number of nurses and their shift schedule is also somewhat fixed on any given day. Oncology drugs, which are expensive, have short shelf lives, and are typically individually formulated for each patient, present their own unique challenges.

Further complicating the process is the linkage of services — the patient often has to go to the lab first for bloodwork, then visit their oncology provider in the clinic before proceeding to the infusion center. Providers often become frustrated when their patients are forced to endure long wait times between the clinic visit and the infusion treatments. They sometimes attempt to “mandate” that their patient should receive their infusion treatment immediately following the clinic visit. But multiple providers mandating the same time slot will result in the infusion center being unable to fulfill the oncologists’ directives.

Most health systems simply ignore the mathematical complexity of matching a highly volatile demand signal with a highly constrained availability of supply. They assume, unquestioningly, that such complexity “comes with the territory” and is therefore unavoidable. As a result, virtually every infusion center experiences the midday peak and predictably long waiting times in the middle of the day.

There is a better way to manage infusion center resources, one that can lead to substantially reduced patient waiting times, improved patient access, smoother ramp-ups and ramp-downs, and a flattening of the midday peak.
5 Steps to Better Infusion Scheduling

These are the core elements of a mathematically-driven solution that addresses the scheduling and asset utilization problems of infusion centers.

**STEP #1**

Build an optimal template to guide schedulers

The current practices of “first come, first scheduled” or offering slots based on a calendar simply do not work. Neither do approaches that attempt to “schedule to a chair” for each patient based on their appointment time or to similarly “schedule to a nurse” by assigning each patient to a specific nurse.

Instead it’s possible to build an “optimal template” based on the specific parameters of each facility’s assets and operations. This template can be engineered to guide schedulers to intelligently sequence the start times of various appointments throughout the day, based on their respective durations.

Simply put, the template tells schedulers how many appointments of each duration should ideally be started at each time slot throughout each day of the week. The objective is to create a smooth ramp-up so as to attain full utilization of the chairs by mid-morning, keep the chair occupancy flat for the majority of the day, and then smoothly ramp down at the end of the day.

Although the schematic of an optimized template looks simple, there is a lot of math beneath its surface. Building an optimal template starts with a thorough mathematical combing of the historical data (minus patient identifiers) to analyze the pattern of patient arrivals by volume, duration of treatment session, and time of day. This enables the creation of a surprisingly accurate forecasting model that predicts the incoming treatment volume and the mix of treatment durations for each day of the week.

Core operational parameters such as nursing shift schedules, nurse-to-patient ratios, lunch break policies for nurses, pharmacy hours and staffing patterns, number of chairs, accuracy of the duration estimates for each center, etc., can be translated into mathematical constraints. The optimization algorithm takes these into account and identifies a set of recommended appointment slots for each hour of each day of the week that is most likely to yield a flat chair-occupancy outcome for the majority of the day.

These recommendations from the optimization algorithms are then embedded in the existing appointment templates within the existing scheduling system, ensuring the schedulers can continue to utilize their current workflow tools. This allows schedulers to start out with a “best possible” position that factors many of these problems into their calculations, instead of from a flawed mosaic that will only become more chaotic as each new problem of the day unfolds.
Regardless of how accurate the optimized templates may be, each day presents a new reality - the volume of patients may be different from the predicted volume, the mix of treatment durations may not perfectly match the expected mix, and/or a scheduler may have been forced to squeeze in an urgent case outside the slots recommended by the template. Also, a nurse or two may have called in sick.

To provide up-to-date guidance to the leadership of the infusion center, a profile of the way today is likely to unfold, given known issues (such as staff shortages), can be automatically generated at the start of each day. With a precision of 10-minute intervals, this mathematically generated profile can point out times throughout the day when the chair capacity may be tight and/or windows of time where add-on patients would best be scheduled. It also gives the nursing leadership insight into whether the day will run smoothly and end on time or whether some level of overtime staffing may be required.

Daily nursing assignments should be data-driven as well. Assigning patients to nurses is yet another crucial decision often made based on experience and instincts. This is actually a classic constraint-based optimization problem - infusion nurses are required to be 100% dedicated to a single patient at the start and near the end of each infusion treatment. Mid-flight, however, it is possible for a single nurse to oversee the treatment of a small group (4-6) of patients, as long as they are in close physical proximity.

As a further complication, some nurses are uniquely qualified to deal with certain types of patients (e.g., bone marrow transplant or lymphoma) or are affiliated with specific oncologists. The idea of a charge nurse drawing up a spreadsheet a few minutes before the start of each day to make nursing assignments no longer seems like an optimal answer.

What is needed is a constraint-based optimization algorithm. An example of an optimal nursing assignment sheet on a given day might look something like the illustration below.

Before we implemented iQueue for Infusion Centers, our nurses were burnt out. They rarely had time for breaks – let alone lunch – and were concerned about patient safety in the daily chaos. Now, nurses not only get their well-deserved breaks, but feel more comfortable and confident in an environment that lacks the ‘feast or famine’ conditions to which they had become accustomed.

Jamie Bachman
Former Executive Director, Oncology Services
While numerous “day of” decisions are important to get right, only so much optimizing can be done at that last minute. To run a consistently high-performing infusion center, it is crucial to be able to look ahead several days or weeks and “groom the schedule” by making small adjustments that are easy to make now but will be harder to implement the day-of. Examples include rescheduling a small number of patients, suggesting they receive their treatment at a different location, modifying a nurse’s shift schedule, or placing a restriction on additional appointments being made within a specific time window.

Grooming the schedule requires a sophisticated prediction of how a day a couple weeks in the future will likely unfold, though many details of that day are not yet known. This is analogous to how Google Maps functions.

Here users enter a destination and a future date/time, and the app gives an accurate estimate of the drive time and the optimal route to be taken on that future day. Google Maps does not for sure know what drivers will be on the road then, which of them will be unusually fast or slow drivers, or which will move into the lane in front of you. Yet the app can give a solid prediction based on historical patterns of traffic, weather, and driving conditions on the specified date of the year and time of day.

Similarly, a “huddle calendar” can be generated to convey the information shown in the illustration below. This calendar can show alert flags on specific days, and give guidance on the highest-leverage grooming actions that can be taken days in advance.

Our nurses love using the huddle report every morning because it gives us a really good indication for if we can take patients back early who arrive early, and for knowing where the day’s best opportunities are for handling add-ons. Our days run much smoother because we are really utilizing our time better.

Joy Lombardi
Manager, RN, OCN
STEP #4

Solve upstream issues to the extent possible

In cases where specific providers may be inadvertently creating bottlenecks by sending too many patients to the infusion center in too short a time period, it may be helpful to capture data demonstrating this and share it with the provider. As noted above, this may persuade the provider to consider “de-clustering” their routine followup appointments with infusion patients so that all of those patients don’t come in for infusions at the same time of day.

STEP #5

Build a learning loop

Infusion centers are not static; their operational realities change frequently. Providers are added, hours of operation change, new clinical trials begin and end, nursing complements change and so on. A template that is optimal today may not be optimal six months from now.

It’s essential to keep track of the operational changes that matter and to have a systematic, continuous method of mining your data to compare actual performance to predicted performance. This way you can identify discrepancies between the two and accurately classify them as either one-off variations or systemic issues resulting from a change in the underlying operational facts.

In the latter case, you might refresh the optimal templates. From our experience, this reconciling process should happen no more than two or three times per year so as to minimally disrupt the operational performance of the infusion center.

We took two years of historical data and pumped that into the analytic engine as well as operating constraints, how many infusion chairs are available, the hours when the chairs are open and the staff that’s available and that’s translated into mathematical equations into iQueue and out comes as a production schedule.

Sridhar Seshadri
Vice President, Cancer Services
Multiple infusion center facilities utilized these five steps to better infusion scheduling. The resulting outcomes show the powerful impact of using data to drive scheduling decisions. Two case studies especially stand out.

**Memorial Sloan Kettering Cancer Center**

The world’s oldest and largest private cancer center, MSKCC has devoted more than 130 years to exceptional patient care, innovative research, and outstanding educational programs.

Over the past 10 years, MSKCC has engaged with various experts to design interactive tools to help better predict and plan for the extreme variability of their high volume infusion units throughout New York City and the surrounding suburbs. Most efforts failed to offer what MSK needed most: a predictive tool or simulation model that could be used for planning volume, visit distribution and resource utilization for infusion units.

MSKCC leaders tested iQueue for Infusion Centers at its 13-chair Gynecologic Oncology Infusion unit in midtown Manhattan with the goal of optimizing their templates, providing daily management guidance about what to expect each day, understanding what went wrong and—most importantly—use schedule alert tools that help staff react to changing conditions.

**RESULTS**

- **31%**  
  **DECREASE IN**  
  Overall average wait times

- **26%**  
  **DECREASE IN**  
  Average wait times during peak hours

- **32%**  
  **DECREASE IN**  
  Average wait times on peak days

- **22%**  
  **INCREASE IN**  
  Average volumes on slowest day of the week
New York Presbyterian

New York Presbyterian is home to two of the nation’s leading cancer centers – the NCI-designated Herbert Irving Comprehensive Cancer Center of NYP/Columbia University Medical Center and the NYP/Weill Cornell Ronald P. Stanton Clinical Cancer Program and the Weill Cornell Medicine Sandra and Edward Meyer Cancer Center. NYP treats some 7,500 adult and pediatric patients newly diagnosed with cancer each year.

After consistently operating at capacity with excessive wait times in the middle of the day, NYP deployed iQueue for Infusion Centers at a 49-chair center to create optimized infusion scheduling templates. They were able to continuously maximize patient flow and chair usage, as illustrated by the utilization curve charts below.

RESULTS

- 55% LOWER Waiting times at peak hours
- 40% LOWER Average waiting time
- 17% HIGHER Patient volumes
Conclusion

Infusion centers all over the country are discovering the power of sophisticated mathematics, supported by data science algorithms and cloud-based software products, to streamline their operations and vastly improve the patient experience. Our five steps to a more streamlined infusion scheduling process are a step in the right direction for better outcomes for patients, providers and infusion center staff. By balancing supply and demand constraints and building templates based on historical data, infusion centers can schedule weeks and even months in advance in a forward-looking way. These methods result in reduced wait time for patients, better projections for infusion center leadership, more accurate scheduling, and greater provider and staff satisfaction.

Using a mathematically-driven solution makes it possible to beat the infusion scheduling game and take Tetris out of play. iQueue for Infusion Centers, working with top cancer centers throughout the country, have developed and perfected the use of AI to facilitate scheduling, reduce average waiting times, drive higher patient volumes, lower overtime pay and increase nursing satisfaction and patient experience scores.

Many more leading health systems who have used this solution continuously over the past five years have seen sustained, significant impact during that time. Visit here to learn more about the outcomes and success of:

Stanford HEALTH CARE

University of California
San Francisco

uchealth

Wake Forest Baptist Health

And more...

“We were very pleased with how fast we were able to implement iQueue for Infusion Centers and see a difference. We see lots of happier patients because things are happening on-time.”

Karen Craver
Clinical Practice Administrator
Contact us for a no obligation demo:

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