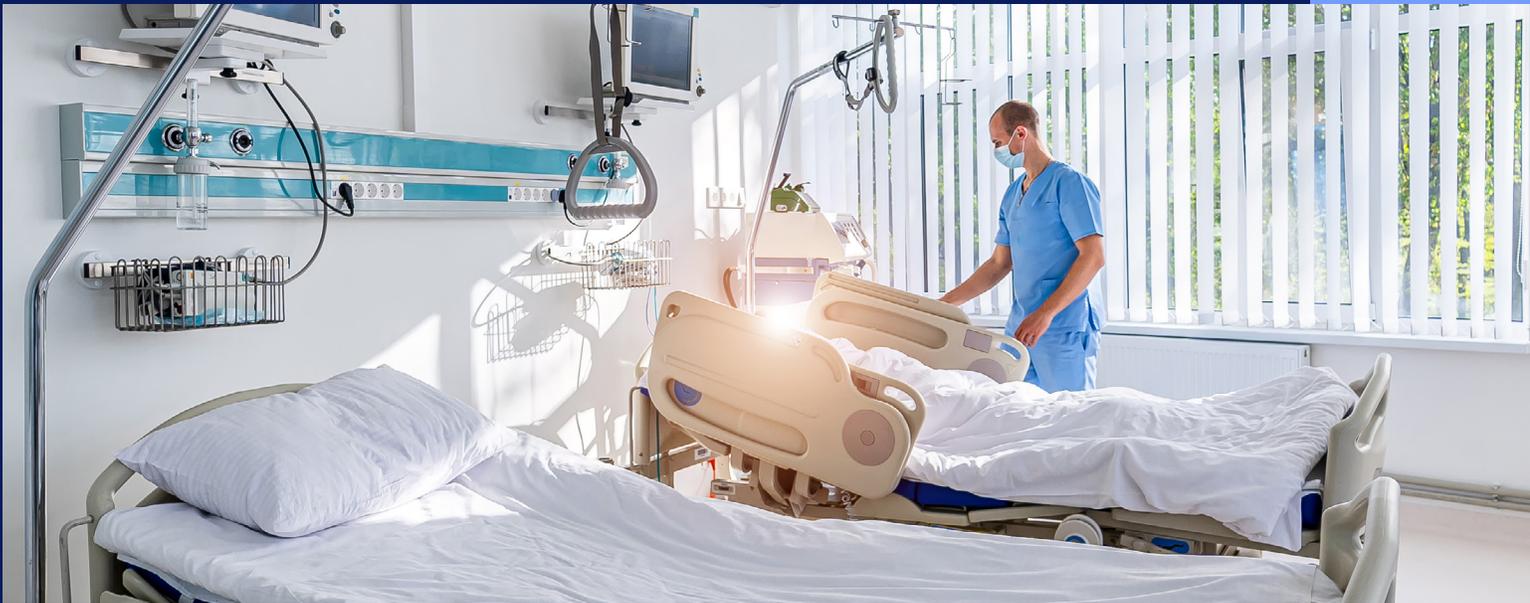


# Unlocking Inpatient Bed Capacity

Using prescriptive analytics and lean principles to optimize patient flow



Inpatient bed capacity has always represented a significant part of a hospital's economic engine, second only to the OR. As growth in outpatient volume continues to rise, hospitals need to strive to be more efficient with their inpatient bed utilization than ever before.

Bed capacity, particularly in the ICU, has become a particular concern in the wake of the COVID-19 pandemic crisis. When we polled 425 health systems in 2020 on their biggest constraints to returning to full OR capacity after the pandemic, 38% cited downstream bed availability as their greatest concern. Even when not in a bed crisis situation, the pure economic value of each inpatient bed is substantial. The flow of patients into and out of inpatient beds is also vitally important to the overall efficient management of the hospital. Hospital staff are well aware of this, frustrated by it, and yet too often have only rudimentary, insufficient tools at their disposal.



## Current Bed Management Practices

Every day, patient-placement personnel, house supervisors, unit charge nurses, and even senior leaders do the best they can to navigate the daily chaos of bed management by doing their best to guess what is going to happen over the course of the day.

Staff rely on huddles throughout the day, where Excel or paper spreadsheets are reviewed to predict how many beds will open up and when. They try to estimate demand for those beds by time of day. They also decide if and when to deploy “surge capacity”, or capacity that the hospital is licensed for but that is opened up only when buffer capacity is needed.

Sometimes a given day works out well, and most patients are placed in the right unit without prolonged waits. Often, however, the staff’s best efforts result in frustration, long waits, staff overtime, reduced reimbursements and lower access to care.

The problem is that the traditional approach of using Excel spreadsheets to get a periodic read of the census, then trying to unlock capacity by discharging patients faster, simply does not work — there are more complex and systemic sets of issues to address, and their results are key to clinical and operational success. Ultimately, however, the key is improving patient flow.

### **DAILY BACKLOG**

Nearly every hospital struggles with a lack of available beds, particularly on the right unit, when patients from the ORs or ED need them, or when patients are transferred in from another facility. This leads to a clogged system that in turn backs up critical areas of the hospital. Patients can’t be moved from units like the ED, OR or PACU until there are open beds to accommodate them.

### **LACK OF PATIENT ACCESS**

Patient access is inversely proportional to LOS (length of stay). The more time outgoing patients spend in their beds, the fewer beds are available for incoming patients. Hence, the impact of even a small change in LOS, in either direction, can be quite significant. Reducing unnecessary bed time for outgoing patients is thus a meaningful goal, but a challenge given backlogs elsewhere in the system.

### **CHANGING THE LOSE-LOSE FORMULA**

The frustration patients and providers experience when they wait a long time for a bed after emergency or surgical care and still sometimes end up with the “wrong” bed (i.e., a bed in a unit without the appropriate level of specialized care) can be avoided by increasing the throughput of the system.

### **MEETING REIMBURSEMENT REQUIREMENTS**

Any extra, avoidable night a patient occupies a bed — and those extra hours a patient waits for discharge — may not be reimbursable, so it is vital for bed flow to remain fluid and patients not to remain in beds unnecessarily.

Overall, improving patient flow will reduce wait times in the ED, OR, PACU, and other hospital departments thereby freeing up resources to attend to patients sooner. It also mitigates problems with boarding and discharge, and there is a generally more stable and positive experience for everyone involved — hospital staff, patients, clinicians, and finance departments.

However, patient flow improvements cannot be addressed in a vacuum. It is crucial to first address the root cause of a mismatch in the demand-supply balance for inpatient beds.

# Demand for Inpatient Bed Grows Before Supply Can Catch Up

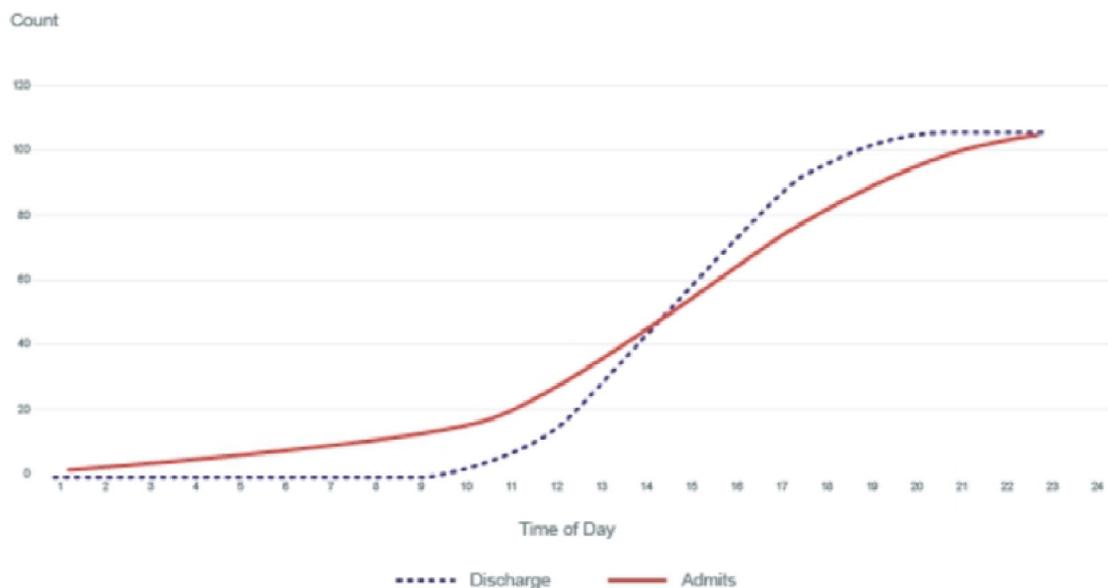
In most hospitals, the demand for beds on a daily basis usually swells before a sufficient supply of beds opens up. This can seem unpredictable, making manually coordinating supply and demand nearly impossible.

*The demand for beds typically grows before beds are available*

Hotels have been successful in moving the arrival and departure patterns in the right direction by establishing a check-out time of 12 noon or earlier and a check-in time of 3pm or later.

It is more complicated for hospitals—they tend to experience the opposite situation: morning surgeries and overnight ED arrivals create a need for beds in the morning, while typical hospital discharge processes render beds available later in the day.

Complicating this is the fact that bed capacity must be divided into “units,” determined by the level of care and skilled staffing required. A patient recovering from serious heart surgery needs a very different type of specialized care than one who has had spinal or orthopedic surgery. There is a “right” or “primary” unit to which a patient needs to be steered to access the correct nursing care, equipment, and doctors. **All this contributes to the limited availability of inpatient beds on a recurring basis.**



The daily demand for beds typically grows before beds are available.

## ON THE DEMAND SIDE:

# Who Will Show Up When and What Bed Will They Need?

A hypothetical 400-bed hospital, Sunnyvale General, is subdivided into 20 units of 20 beds each; ortho, neuro, cardio, relevant ICU units, and so on. The need for beds at Sunnyvale General will be driven by all the following:



### WHEN AND HOW MANY ELECTIVE, SCHEDULED, AND EMERGENT SURGERIES OF EACH TYPE ARE DONE

The way OR blocks are allocated by day of week, and by surgeon or service line, will determine how much bed-demand will be placed on each unit.



### INFLOW FROM THE EMERGENCY DEPARTMENT

Patients may come in from the ED requiring emergency surgery or other procedures that necessitate overnight stays.



### INFLOW FROM TRANSFERS

Some hospitals accept transfers from other institutions because they are able to provide more specialized care for certain conditions.



### VOLUME AND TIMING OF ADD-ON SURGERIES

Late-scheduled cases that surgeons add on outside of their block time, or in open time, may create the need for beds.



### PATIENTS WHO ARE ADMITTED DIRECTLY

These might include scheduled inpatient treatments or procedures, or acutely ill patients admitted from outpatient visits.



Thus the “demand signal” adds up in a different way on any given day and from week to week. As the demand constantly changes, Sunnyvale’s staff struggles to place the right patient in the right bed at the right time.



(We are) “holding much more proactive conversations with nurses and physicians when we know flow will be impacted ... So much easier to nudge as events occur to address burnout / well being.”

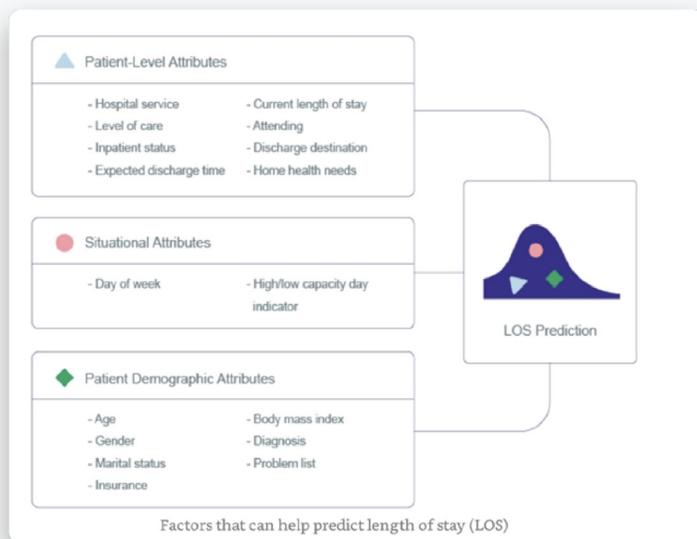
**Dr. Michael,**  
Medical Director of Emergency Department

# When Will the Right Bed Open Up?

A hypothetical 400-bed hospital, Sunnyvale General, is subdivided into 20 units of 20 beds each; ortho, neuro, cardio, relevant ICU units, and so on. The need for beds at Sunnyvale General will be driven by all the following:

**Unit variances.** Patient length of stay (LOS) in each unit can vary widely, from two days up to five days, and in some cases much longer. At Sunnyvale General, unit X, with a two-day LOS frees up ten of their 20 beds daily; unit Y, with an LOS of five days, will be freeing up four beds per day, and so on.

**Discharge order times.** In order to discharge a patient, the attending physician needs to write the discharge order, which can come at varying times of the day. Clinician schedules, including cross-scheduling between departments, and timing of patient test results also influence this.



**Unpredictable delays in placing discharge orders.** A certain percentage of patients who are expected to pass their tests or to have good lab results will not pass and need to stay an extra day or two.

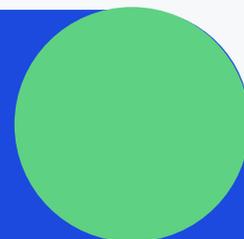
**Delays in discharge after the order is placed.** Even after a patient has been cleared for discharge, multiple delays in making their bed available for an incoming patient can occur:

- “Avoidable delays” — for example, problems with insurance documentation or with available space at a SNF (skilled nursing facility).
- Waiting for prescriptions: The discharge order might come with a set of prescriptions, and if the pharmacy is backed up the patient may need to wait.
- Waiting for exit transport: Wheeling the patient from the bed to their family/transportation pickup spot requires appropriate support-staff to be available in the right unit at the right time.
- Waiting for transportation home: If the patient’s family or other transportation isn’t available at discharge time, that could further add to the delay.
- Waiting for medical equipment and supplies: Such items need to be ordered, picked up, and delivered to the patient.
- Waiting for Housekeeping/Environmental Services: Once the patient leaves, getting the room and bed ready for the next patient requires the right services to be available in the right unit at the right time.



It is such a powerful capability since it connects the dots between the data, the insight and sophisticated algorithms to provide actionable guidance to the front line. ”

**Steve Hess,**  
Chief Information Officer UCHealth



# Ten Ways to “Smooth” the Mismatch in the Supply-Demand Pattern

In our work across health systems, we have found ten potential levers which — if backed by the right predictive analytics engine, easy-to-use tools, and supporting people and processes — can help unlock supply, shape demand, and successfully match bed supply and demand together. These empower hospitals to improve their patient flow and enable smoother operations in inpatient units overall.

## 1. PLACE PATIENTS USING SOPHISTICATED DEMAND-SUPPLY MODELS

The core approach to the optimal placement of patients is accurately forecasting and matching demand and supply, unit by unit, by time of day, each and every day — given the existing structure of supply and the complex variety of demand signals.

**Supply:** Model the availability and timing of beds that will come available in each unit. Use historical data to mathematically create a “fingerprint”; a model for each unit that predicts, for each hour of each day of the week, the likely number of patients that will be discharged. The predictions are augmented by real-time feeds, just as an app like Waze takes a baseline prediction from the speed of traffic for each section of the roadway for each minute of each day of the week, but relies on real-time updates to fine-tune the model. This model can be used to address incoming demand signals (see below) and enable hospital staff to make concrete placement decisions about individual patients.

**Demand:** Use specifically tailored models to create an “upcoming demand signal” at any time of the day for each element of demand. These elements can include incoming volumes from the OR and ED, and external and internal transfers. Here too, the models should be updated on real-time feeds that capture any delays or cancelation of surgeries on an unanticipated surge in arrivals to the ED.

Supply and demand side models can then be used, with software, to create tools that give patient-placement leaders

visibility into upcoming demand and supply for beds, unit by unit, enabling them to make fact-based tradeoffs and experiment with potential bed distributions. It allows patient placement leaders to play the “chess game” by anticipating the next several moves well in advance of when they will actually occur. This leads to dramatically better outcomes than a purely reactive response to deciding on immediate placement without an appreciation for how the unit capacities will unfold over the coming minutes and hours.

## 2. MAKE DATA-DRIVEN INTERNAL TRANSFER DECISIONS

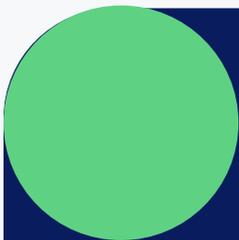
Internal transfer requests are often viewed as an added burden to be executed only when convenient. In fact transfers can be a strategic lever since they could free up a bed that will be needed in the near future. By thinking a few moves ahead via the scenario-building tool described above and moving the right patients to appropriate open beds, placement teams can open up the right slots to meet expected demand for high-value beds.

## 3. UNLOCK SUPPLY: RIGHT-SIZE YOUR UNIT CAPACITY

Fundamental unit sizing must be constructed correctly, using data from historical demand. If it is not, a higher percentage of patients will fail to be placed in their target units. The correct number of required beds can be computed — and adjusted, and staffed — for a given unit by analyzing historical patient volumes by service and by day of week.

## 4. LOOK HARD AT THE “DEGREE OF SPECIALIZATION” SO AS TO POOL CAPACITY WHERE POSSIBLE

If a hospital has too many specialized units, this can lead to more cumbersome placement problems than if they created a larger, more flexible pool of beds. If and when hospitals can combine subunits to open a larger (“virtual”) general medicine unit without sacrificing quality of care, they may be able to simplify patient placement and potentially co-locate patients assigned to a given clinical team.



Effective inpatient capacity management improves patient care, provider experience, and hospital efficiency by strategically allocating a fixed supply of beds. This requires the ability to anticipate variances in bed demand across clinical specialties, patient demographic groups, and time. ”

**Isobel Handler,**  
Clinical Resource Management Director at UCHHealth

## 5. SMOOTH THE PATIENT FLOW FROM THE OPERATING ROOM (OR)

The flow of patients from the OR into inpatient beds often accounts for 20-25 percent of the bed demand on any given day, and can cause spikes in the inpatient census. This flow is in fact more “controllable” than the census contribution from the ED. Optimizing the elective surgery schedule with respect to recovery time can yield a flatter inpatient census. Such “surgical smoothing” can be done by forecasting the volume and case mix of surgeries, again using tools to develop templates for scheduling.

## 6. IMPROVE PROVIDER WORKFLOW

In many hospitals, physician rounding occurs in the late morning or early afternoon. This timing can lead to missed opportunities to discharge patients early in the day. Simple measures such as maintaining a list of patients who can likely be discharged early and having providers round on those patients in the morning can help open beds earlier, provided clinical teams are able to cooperate. Adding administrative support to provider teams to help plan and execute discharges can also go a long way.

## 7. DON'T LET A DIME HOLD UP A DOLLAR — LOOK AT STAFFING LEVELS, TRANSPORTATION, AND HOURS OF OPERATIONS

A “dime is holding up dollar” if:

- Patient discharges are frequently delayed by lack of available transportation
- Bed turnover is reduced due to a wait for housekeeping services
- Length of stay is increased because needed test results are held up by an overworked services unit such as a Lab or Imaging (or any that is closed outside of regular business hours)

Taking on relatively small costs to strengthen functions like transportation, housekeeping, and the operation of supporting services can have an outsized impact on a highly valuable asset: the placement of a patient in the right bed.

## 8. USE PREDICTIVE DISCHARGE PLANNING TO FOCUS CASE TEAMS AND SOCIAL SERVICES

Avoidable discharge delays often occur at the end of a patient’s stay, such as issues with insurance documentation, transportation, and available space at extended care facilities. Many of these could be avoided if case managers were alerted to the problem a day or two before the actual discharge. Historical data regarding avoidable discharge delays can be collected, and a machine-learning model can be used to identify key case attributes that indicate and alert possible discharge delays early on.

## 9. PRIORITIZE SOON-TO-BE-DISCHARGED PATIENTS IN QUEUES FOR LABS/CLINICAL PROCEDURES

Hospitals typically prioritize clinically urgent cases in their lab queues, while less urgent cases are usually first-come, first-served. They can also identify patients who are nearing discharge and place them in a prioritized queue. This can help ensure lab test results do not unnecessarily delay the discharge process. Since most hospitals already have a prioritization process in place for their lab queues, updating the system to include patients close to discharge should be relatively easy.

## 10. TRANSITION SOME PROCEDURES TO OUTPATIENT

Sometimes it is more cost-effective to schedule procedures as outpatient rather than inpatient, particularly if the patient resides locally. It may be helpful to categorically identify types of procedures and patients that are good candidates for treatment in an outpatient setting. Non-local patients may even be directed to a local hotel overnight, with instructions to report in the morning for an outpatient procedure. Because this is a medical decision, an analytic system alone may not be able to identify candidate patients/procedures with the confidence level required. But the system can at least help identify possibilities.

Each of these ideas is worth evaluating based on the specific circumstances of any given health system. While some of them will require changing familiar processes and habits, as well as learning and implementing new tools, the investment is definitely worthwhile.

Below is the summary of the impact on a healthcare system who used our solution, iQueue for Inpatient Beds, to transform bed capacity management and improve outcomes overall.



Effective inpatient capacity management improves patient care, provider experience, and hospital efficiency by strategically allocating a fixed supply of beds. This requires the ability to anticipate variances in bed demand across clinical specialties, patient demographic groups, and time. ”

**Isobel Handler,**  
Clinical Resource  
Management Director at UHealth

# How UCHealth Achieved Better Bed Capacity Management

## ABOUT UC HEALTH

- Integrated Healthcare Delivery System
- System-wide Epic network
- 12 hospitals, 1,987 inpatient hospital beds, and 136,000+ admissions and observation visits per year
- Serves Colorado, southern Wyoming, and areas of Nebraska.

## THE PROBLEM

### Home-grown tools required daily manual preparation

The bed management system required nurses to enter when patients were “ready to move”, after physicians wrote downgrade orders for transfer to lower levels of care.

Had access to reports, worklists, dashboards and an extensive amount of data, **but none of these provided real-time data or accurate predictions of what would happen in the future in order to guide specific decisions that needed to be made throughout the day.**

### UCHealth needed

A data-driven approach to help plan for tomorrow and manage needs for today. A single source of truth for bed capacity management --to share in real-time across departments, clinical disciplines, and the health system as a whole.

## SOLUTION

UCHealth partnered with LeanTaaS to implement iQueue for Inpatient Beds. Using real-time data plus predictive and prescriptive analytics, iQueue for Inpatient Beds helps improve patient flow by reducing wait times at key steps along the patient journey and mitigates the chaos historically inherent in managing bed capacity. iQueue for Inpatient Beds has been live at UCHealth’s 569-bed main hospital since February 2020, and at 12 of UCHealth’s Colorado hospitals since October 2020.

When using the solution, UCHealth staff are able to predict future admissions and discharges, balance beds across the network, hospital, and unit, and confidently make strategic decisions to get the right patient in the right bed at the right time.

The staff can quickly view capacity status at any time and from any location, and instantly see which units are performing strongly with discharges and which are falling behind and need more support from staff to decrease delays. They can also identify specific patients to be discharged soon, and facilitate those discharges as needed.

## RESULTS

Systemwide, the organization uses iQueue for Inpatient Beds to run daily bed meetings, perform hourly administrative management, and drive capacity protocol standardization. Patient flow metrics have noticeably improved.

### WANT TO LEARN MORE?

To discover more solutions to unlocking inpatient bed capacity, visit and contact us [here](#).

## RESULTS

▼ **37%**

**LOWER**  
Time to Complete  
ICU transfers

▼ **8%**

**DECREASE IN**  
Opportunity Days  
(Difference between Med/  
Surg LOS and CMS LOS)

▼ **4%**

**DECREASE IN**  
Time to Admit  
(despite 18% increase  
in COVID-19 census)

▲ **90%**

**INCREASE IN**  
Improved confidence in  
critical capacity decisions  
(compared to only 50%)



Contact us for a no obligation demo:

[info@leantaas.com](mailto:info@leantaas.com)

[www.leantaas.com](http://www.leantaas.com)

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