WHITE PAPER

HOW ADVANCED ANALYTICS CAN IMPROVE HOSPITAL CAPACITY MANAGEMENT

– Dr. Keerthi Kumar, Dr. Lokendra Shastri

Infosys®
Navigate your next

Improper capacity management creates widespread inefficiency

Overcrowded emergency rooms and long patient queues are a familiar sight at most hospitals. While on the surface it may appear that hospitals are working beyond full capacity, these may just be a symptom of poor capacity management. Ironically, improper capacity management can also create imbalances that leave other resources under utilised.

The utilisation and management of capacity in a hospital is impacted by all of the following:

- Emergency Department (ED) overcrowding
- Scheduling
- Patient Flow Management
- Discharge Co-ordination
- Bed Turnover

Since the ED is the gateway for a majority of patients visiting the hospital, the effects of downstream bottlenecks are felt the strongest out there. No doubt, the emergency section is a busy place; however, it may be overcrowded owing to totally different reasons, such as delays in transporting patients to the ward, which in turn might be due to the unavailability of beds. ED congestion creates multiple problems - patients may pick up other infections while waiting for treatment, personnel come under pressure to manage the "rush" and the hospital risks losing both reputation and revenue. Worst of all, since new patients cannot be accommodated until the "boarders" leave, the treatment capacity of the ED may not even be fully utilised.

Scheduling of surgical or diagnostic procedures is another important function in any hospital. In order to schedule efficiently, hospitals need visibility into expected patient demand at least over the next twenty-four hours. That calls for a scientific forecasting mechanism which can accurately predict short-term demand trends. Hospital personnel need this information to not only schedule various procedures but also ensure that the necessary resources in terms of medical staff and equipment are made available. In fact, not just the supply side, even demand may be managed better. This is best illustrated with an example. It is seen that the workload at hospitals gradually increases at the beginning of every week to peak on Wednesdays, after which it tapers off. If the scheduling desk is made aware of this trend, they can smooth the demand pattern by re-assigning at least some procedures scheduled for Wednesday to other days of the week and thereby improve overall capacity utilisation.

The same principle can be applied to diagnostic services such as radiology, pathology, biochemistry and so on.

The flow of patients from one department to the other must be carefully managed in order to prevent bottlenecks within the system. For example, patients requiring admission must not be kept waiting in the emergency section. In fact, this principle applies throughout the organization - whether it is a movement from surgery to intensive care, or from the step-down unit to the recovery room, the necessary hand-offs must be completed in a smooth and timely fashion. It is worth mentioning here that the hand-off includes not just the physical movement of the patients but also the relevant documentation. Patient care co-ordination is crucial in ensuring that the transfer-out, transfer-in and transportation in-between occur seamlessly. Just as the relieving unit must prepare the patients and their paperwork, the receiving unit must ready the facilities and arrange for any special equipment that is required, so that the patients are not made to wait or inconvenienced in any other way.

On the flip side, improper patient care co-ordination can once again result in capacity wastage.

Hospitals are constrained by a lack of analytical tools

Although hospital management recognize the importance of optimising all the above, their efforts are hampered by the following challenges:

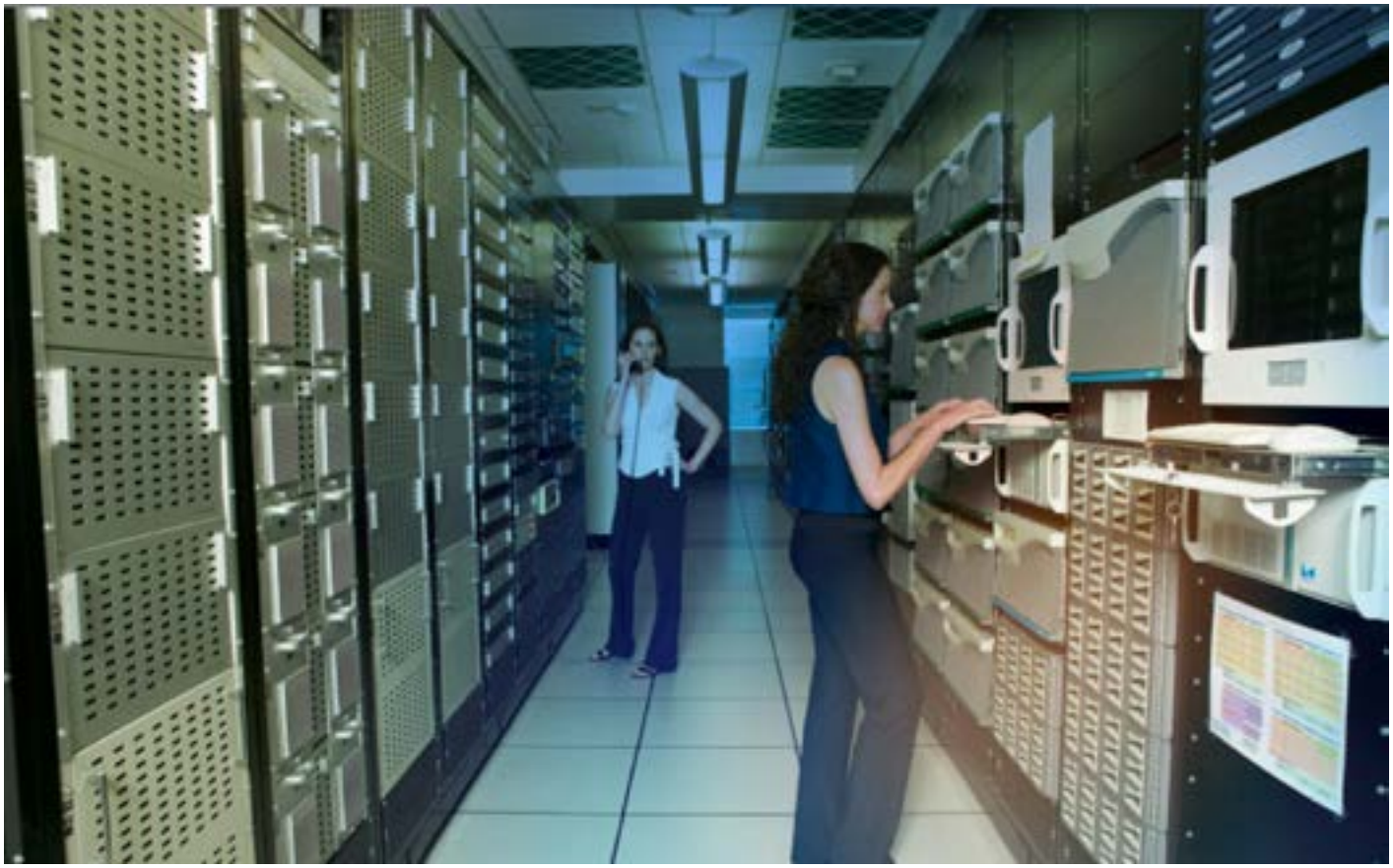
Lack of powerful forecasting tools

Even today, hospitals use the rule of thumb or rudimentary forecasting methods to predict patient inflow. Since capacity and resource planning are done based on such forecasts, any inaccuracy in demand estimation results in an under or over-allocation of both. When capacity is overloaded, hospitals are at a risk of losing business by way of patient diversion and dissatisfaction. In the opposite scenario, idle resources drive down operational efficiency. It follows naturally that when capacity planning is off target, hospital schedules and any attempts at demand smoothening, are also thrown out of gear.

Lack of real-time information flows

Most hospitals lack a clear communication system across departmental silos. As a result, hospital personnel have little real-time visibility into patient flows, resource demand or capacity positions, all of which are pre-requisites for optimal patient care co-ordination. This results in long waiting time for patients and loss of opportunity for the institutions. For example, a patient might be stuck in the ED, waiting for a room to fall vacant. At the same time, another patient may be due for discharge on one of the floors. Since the floor is unaware of the patient waiting in the ED, they may not process the discharge on priority.

Advanced Analytics can help hospitals meet the capacity management challenge



Clearly, the availability of powerful forecasting and reporting tools can enable hospitals overcome these challenges and consequently manage their capacity more efficiently. The answer lies in Advanced Analytics, which goes beyond mere presentation of historical trends and estimation of broad demand, as described below:

Demand forecasting: These solutions employ scientific and reliable methods to make both short and long term predictions, which enable hospitals to optimally utilize their limited resources. Certain Predictive Analytics solutions can forecast short term demand at different intervals over the next 24 hours, using pre-defined or probabilistic patient pathways that indicate the services a patient might need at any given time and the probable length of stay. Ideally, the solution must be self-learning, wherein the outcome of a preceding activity predicts the requirements of the succeeding one.

Long term forecasting helps hospitals assess their capacity building needs and plan the necessary capital expenditure based on patient volume, Average Length of Stay (ALOS), equipment utilisation and disease trends.

Thus, forecasting simplifies the task of hospital staff on two levels: the short term projection enables them to arrange the workload and necessary resources for the next few shifts, whereas the long term forecast helps them plan capacity over the coming weeks, months or even years.

Waiting time management: Long wait times are a pain point for both hospitals and patients alike. For instance, a patient waiting to be transported out of ICU runs the risk of contracting infection; on the other hand, the hospital suffers equally, as it is unable to monetise the expensive ICU capacity, which is being blocked by the "boarder". In fact, it's not just patients who wait - care givers, administrators and support staff also experience frustrating delays, likely caused by system bottlenecks, process inefficiencies, poor capacity management, and so on. Advanced Analytics can help break down the wait time into smaller manageable parts by providing key indicators such as:

- Average Process Turnaround Time,
- Average Delay Time, Number of Process Delay Events
- Average Wait Times per Patient

More importantly, it can facilitate root cause analysis by identifying the principal reasons behind delays and wait times. On the other hand, should hospital staff wish to know the expected wait times over the next several hours, they can leverage Advanced Analytics to answer that question as well. The solution lies in

real-time monitoring and automation of workflow to drive subsequent action. In this case, as soon as the physician orders a discharge, a trigger alert must go to the nursing and housekeeping unit to process the same. The bed status on the enterprise bed-census dashboard should be updated to "discharge initiated". Administration staff can use this information in conjunction with the average discharge cycle time to assess when beds will be ready for occupancy and accordingly allot them to incoming patients. They can also arrange patients to be transported at the appropriate time. In case the discharge is not completed within a pre-defined time frame, a status update must automatically be sent to a supervising manager so that he or she may intervene.

Below is a sample dashboard providing intuitive information on bed status, critical process times and alerts to an operational manager.

Variability measurement: Variability is intrinsic to healthcare, with clinical conditions, patient flow and service provider capability varying from hospital to hospital. That being said, hospitals add to this variability by using "rule of thumb" techniques to calculate important metrics such as volume, census and occupancy rates. Any variation in these result in flow problems as illustrated by this example: The mean weekly elective surgical volume for two hospitals may be 125 patient cases each. Hospital A has a steady flow of surgical cases throughout the week, enabling optimal scheduling. On the other hand, Hospital B schedules 50 percent of its cases on Mondays and Wednesdays and 50 percent on the remaining days. Because the caseload is so high on Mondays and Wednesdays, there is no room to accommodate seemingly random but historically predictable surgical complications or additional cases. Any extra load is manifest as waits, delays, and cancellations. In this scenario, the use of Advanced Analytics can make measurement of variability much more scientific and thereby increase predictability.

Process-inefficiency reduction: Inefficient processes can lead to sub-optimal care, costing both hospitals and patients. A visit to the doctor comprises a series of activities including registration, transportation to the examination room, medical examination and checkout, with waiting time in between. Consequently, the patients' interaction with the physician, which is the main purpose of the visit, takes only a fraction of the entire time spent. This inconveniences the patients and in the worst case could worsen their medical condition.

Therefore, hospitals must do their best to identify and eliminate unproductive effort. That calls for the establishment of standard operating procedures for all disease conditions and recording of time spent on individual tasks. When this information has been collected over a certain period, Advanced Analytics can provide valuable insight into how productively the hospital has utilized time, and which of its processes are the most inefficient.

Reporting and decision support: The optimal decision support tool is one that enables organisations to take corrective action. Therefore, it must be capable of delivering actionable information to decision makers, administrators, support staff and other users. Since Advanced Analytics is built around the needs of actual users, it boasts of powerful reporting and decision support features.

How to choose the right Advanced Analytics solution

Although Advanced Analytics has powerful capability, not all available solutions pack the same performance. While most solutions can help in forecasting and scheduling, they are limited by their use of static data. That being said, there are exceptions. Certain vendors' solutions stand apart from the rest in their ability to use dynamic information, so that the results are updated as events unfold in real-time. One of the advantages of dynamic forecasting and scheduling is Straight Through Processing of patients, which minimises their wait times and duration of stay.

Going a step further, some solutions are capable of forecasting and scheduling at individual patient-level. By co-relating past patient flows with clinical and demographic characteristics, the solutions can chart the likely path that a patient inside the hospital will take. Specifically, such solutions can predict a patient's length of stay in various departments such as emergency, surgery and recovery as well as anticipate the need for allied services such as radiology or pathology. Moreover, because of their dynamic capability, the solutions can update the pathways as patients physically move within the hospital premises. Needless to say, this information can be very valuable to those in charge of patient care co-ordination, scheduling or capacity planning.

Certain vendors of Advanced Analytics solutions have incorporated domain knowledge into their solutions so that they are optimised to serve the needs of the hospital segment.

Last but not least, there must be demonstrable evidence of the solution's commercial viability. Any improvement in hospital capacity management must manifest itself as better patient throughput and higher admissions. Proven solutions can deliver up to 10% improvement in bed utilisation, creating substantial payback for hospitals. For instance, a 5% improvement in bed utilisation at a hospital with annual bed-revenues of US $ 300 million can return 8 to 10 times the total cost of ownership of the analytics solution within the first year itself.

Summary

Capacity management is among hospitals' key challenges. When hospitals do not successfully manage capacity assets, they suffer by way of revenue loss, operational inefficiency, delays and patient dissatisfaction. Efficient capacity management can only be built upon a foundation of accurate forecasting and timely scheduling. Unfortunately, most hospitals continue to use unscientific methods for both.

Advanced Analytics can impact the way hospitals manage their capacity and other processes by enabling forecasting and scheduling for the immediate and longer term. Some solutions even have dynamic capability, which implies that their analyses are updated in real-time. Another desirable attribute is the ability to predict each patient's pathway within the hospital. Hospitals seeking to acquire an Advanced Analytics solution would do well to bear these factors in mind.

About the Authors

Dr. Keerthi Kumar is a Process Consultant with the healthcare consulting practice of Infosys Limited. He specializes in the design and development of IT-enabled business solutions, in the healthcare payer and provider domains. He has developed and implemented solutions in the data warehousing, business intelligence and Enterprise Performance Management domains. A medical doctor by training, Dr. Keerthi also holds an M.B.A (International Business) degree. He is currently involved in the development of enterprise performance solutions addressing clinical quality, regulatory compliance and capacity optimization for healthcare providers.

Dr. Lokendra Shastri is General Manager, Research, and Head of Center for Knowledge Driven Information Systems - SETLabs, at Infosys. Dr. Shastri has made significant contributions in the areas of scalable, parallel models of knowledge representation and inference, semantic networks, neural networks, and episodic memory. He has authored a book and served on the editorial boards of Connection Science and IEEE Expert, the advisory board of Human Cognitive Processing, and the program committees of conferences on AI and Cognitive Science.

For more information, contact askus@infosys.com

Infosys®
Navigate your next