

View Point



Bed Management Optimization

Dr Ramachandran Balaji, Mark Brownlee

Though Bed Management is a core operational activity in all hospitals, many hospitals have problems with it. This seemingly simple activity is anything but that. Few institutions have complete visibility of this process as it weaves its way through the organization and fewer still have a means of measuring the performance of the activity that results in the availability of a bed. Optimizing Bed Management is critical to the efficient functioning of any hospital.

This paper proposes a way to analyze, control and optimize this process.

Bed Management - Not As Simple As It Seems

Bed Management is a background activity in hospitals that few consciously notice - at least not until something goes wrong. Inefficient, or worse, ineffective Bed Management is the bane of hospitals all over the country, bringing in its wake myriads of problems for patients, nurses, physicians, and administrators.

In many hospitals, Emergency Rooms (ER) and admission offices are often overcrowded with patients waiting for rooms. This forces physicians to move patients around or to start using competing local hospitals. Sometimes, patients must be accommodated in halls. At other times, poor Bed Management puts valuable ER rooms out of use, leading to treatment limitations for critically ill patients.

In all these scenarios, patient and physician dissatisfaction is the immediate result, not to speak of a long term decrease in admissions. At times, the very safety of patients is at risk. While the exact problems and their results can vary, the fact remains that these problems are avoidable.

Although automated support can help in efficient Bed Management, the key to any real improvement lies with workflow complexity and operational performance. While staff performance plays a big role, it is process design and management - or the lack of it - that needs to be tackled on a priority basis.

Bed Management is an operation in constant evolution which is usually not controlled at the process level. Typically, managers are faced with performance issues that are inwardly focused within their groups. But given the complexities of hospital operations today, all operational areas are interrelated. Thus, any significant improvement requires a fresh perspective - a cross functional or process view. In this view, the entire function of Bed Management is open for review and management and changes, if any, must be incorporated into the work and workflow of the department.

This requires a two-level approach to Operational Management and Optimization:

- Process-level Management and Optimization
- Followed by Operational Workflow Management and Optimization within the department

Unfortunately, few organizations have this level of operational visibility or control. We have found that for most organizations, 'process' maps are at the internal organization level and really reflect workflow, not process (which is cross-organizational). We have also found that few organizations pay much attention to their operational maps once they are created and fewer still keep them up to-date or use them to guide improvement. Without this process-level view, work can only be improved at the local workflow level and the overall process cannot be improved or optimized. For efficient Bed Management, the two-level approach is absolutely critical. It is important that the entire process is optimized as a first step. Then, the parts of the process that lie within each organization should be operationally optimized.

A process-level view of Bed Management provides insights into all the activities of different groups - from Admission/ Discharge/Transfer (ADT) to House-Keeping to ER and so on - and how these activities flow. Maps of these activities comprise work steps from all organizations even remotely involved in the process. As such, it is important that any map be cross-referenced at the step level with the organization that performs the step. As the flow of information and activity is mapped, the steps take on a context that shows decisions, rules and relationships.

In any process, application systems have a significant impact on productivity and downstream work. But in most hospitals, the systems support only part of the Bed Management process. This causes process disconnects as the work and the systems that support the work are often poorly tied. While this is often a workflow problem rather than a systems problem, it can be both. These disconnects happen because of hidden manual and automated components that often fail to work in close sync to offer a smooth working process.

By providing application support at the points it is used ('touch points'), the management can easily view the impact - or lack of it - at all steps and at an overall level. This association of step, work, and support can be augmented with data needs, use, flow, and transform information to provide a firm understanding of the operation.

Known patient volume information and problems can now be added to the process maps to complete the picture of the operation. Once the hospital enters this information into a Business Process Management (BPM) tool, it will be in a position to:

- Modify the process
- Define process management activity
- Generate process management applications
- Begin to control the process's evolution

The process can then be analyzed and operational 'breakpoints' defined. Break points are places in the process where the activity breaks down or where the clinical quality is affected. By determining the factors that cause these problems, the management will be able to describe them in terms of characteristics. These characteristics can then be viewed as a grouping of factors that can be associated with one or more work steps and measured. This is the driver for real-time dashboard support for the process.

Dashboards Show Real-time Activity

Once the process is understood and the break points identified and defined in a way that lets management measure operational flow, a comprehensive dashboard that shows real-time activity must be put in place. This dashboard should measure activities in all departments involved in the Bed Management process and show workload or delays, etc. Alerts should be included as the backlog or time approaches set limits, with drill down information on what is causing the alert. Management can then take pre-emptive action based on such information. Over a given time, management is also able to define trends and operating scenarios that set the stage for problems.

The challenge of setting up the dashboard has nothing to do with technology. There are several good dashboard products that can do the job. Interfacing is a challenge, but that can be handled with brute workforce. The real issue that can make or break the operational management and improvement effort is an understanding of what to measure. This is an area that is most often not given the attention it deserves.

Hospitals don't need to overburden managers or staff with meaningless monitoring or performance measurements because the key to performance management is the control of activity at the break points. These are the points where things come together or delays occur. They are not necessarily points where the problem actually occurs. Those are defined in the characteristics that describe what can go wrong to cause a problem at the break point. While the dashboard should provide detailed drill down information for management to take corrective action, the monitoring must be at key activity completion points. The dashboards can thus track breakpoint information against defined criteria with limit and aging logic, and provide alerts. Using a drill down for alerts, the dashboard shows the exact cause of the problem.

Defining Bed Management's Problems

With the process maps in place, the business rules defined and the dashboards in place, management can now watch the process in real time and take corrective action before a problem occurs. But the ability to take corrective action, although important, must not be viewed as the preferred operating state. Rather, it is a required underlying ability.

The recommended operating state takes this one step further. It is important to use the information found through performance measurement to identify operating weaknesses and problems. These can range from a misalignment of activity to strategy and misunderstanding policies. But regardless of the problem, management can now quickly identify problems and their causes.

Once problems have been defined in the context of their operational steps, they can be designed out of the process and the operation. This is where operational improvement methods such as Six Sigma play a significant role. To make use of the information provided through this approach, all measurement and change must be managed through the process maps imbedded in the BPM tools. These process maps are as useful as the institution's commitment to their use allows. If the organization views these models and information as a one-time project, they are not kept up-to-date and simply become 'shelf art'. However, if the organization is committed to moving to a process-based approach to Bed Management, the models and information become the starting point for all change and process management optimization.

Some of the problems in a Bed Management process include

- Inter- and intra-department communications
- Disagreements on problem causes and ownership of problem correction
- Department turf issues
- Policy issues
- A lack of integration between systems that increase manual work in bed scheduling and bed preparation

The impact of these problems is often as follows:

- Patients end up:
 - Waiting too long for treatment
 - Being boarded in ERs, being treated in less safe settings
 - Being diverted to another hospital
- Surgeries are delayed or canceled
- Care coordination issues
- Unnecessary patient safety issues
- Patient and physician dissatisfaction resulting from long waits for bed assignment
- Eventual assignment of a bed in a nursing unit that may not specialize in the patient's illness or condition
- Negative revenue impact owing to poor resource and facility utilization (such as ER overcrowding) In moving forward to improve Bed Management, a variety of challenges must be overcome. While these vary from hospital to hospital, the list of challenges likely includes:
 - Balancing demands from the different patient entry or transfer points such as ER, OR, and admitting physicians
 - Operational coordination among the various groups as a result of poor communication among the various stakeholders
 - Poor visibility of the Bed Management process
 - Bed Management tracking - status in each part of the Bed Management process
 - Up-to-date information - bed availability not shown/ updated in the system
 - Delays in patient discharge
 - Delayed bed cleaning - uncoordinated housekeeping activity

What can be done to fix Bed Management problems?

The factors that make Bed Management complicated are:

- **A lack of end-to-end process visibility and management:** Activities in the different departments that contribute to the overall Bed Management function are segmented with no one overall process manager
- **Application interoperability:** Data handoff and sharing are usually inadequate to support operational scenarios - that span departments - in an efficient and timely manner
- **Inflexible specialization:** Specialty nurses are geared toward specific patient populations. This results in a high degree of customization and leads to lack of flexibility in bed assignment when units reach their maximum capacity
- **Bed assignment mismatch:** Assignment to a bed in a nursing unit that specializes in treatment unrelated to the patient's condition. This happens because of bed shortages and leads to potential patient problems in terms of quality of care, clinical outcomes, and increased length of stay
- **Delays:** Patients often wait for hours to be admitted and assigned a bed. This puts a strain on the ER, resulting in inefficient use of ER resources

- **Poorly supported patient care strategies:** Units are organized to provide progressive care, and a change in the patient's condition is marked by movement from one bed to another. E.g. The obstetrics division contains labor rooms, delivery rooms, postpartum beds, maternity beds, and nurseries for newborns. It is often seen that a bottleneck to patient flow occurs due to lack of advance planning and visibility into anticipated patient movements - a 'blocked transfer' situation which prevents the patient from getting the right medical attention (bed) at the right time. Bed assignment thus becomes an ad hoc activity
- **Timely information:** Nursing supervisors generally have easy access to terminals to monitor bed status. However, the data is often hours old and of little practical use, leading to reliance on the telephone to locate available beds
- **Bed assignment to the most appropriate nursing unit:** Alignment of patient placement to physician rounds area. Today, physicians may need to travel to multiple wards and possibly to multiple buildings to see patients

Some things to consider when improving the Bed Management process:

- Ability to identify capacity statistics and patient information such as admissions, discharges, room information, and basic patient demographics through the ADT interface capability
- Capacity to support multiple users logged in concurrently at multiple sites
- User-friendly interface
- Real-time notification to bed cleaning/housekeeping services regarding bed status
- Multi-level performance tracking report package
- View of house capacity in one-screen/scroll view
- Ability to view and track:
 - Current bed status
 - Pending admissions
 - Transfer requests
 - Off-service placement
- Provide a real-time view into key operational performance variables such as:
 - Cycle times from door to discharge
 - Key throughput milestones by acuity level such as: door to disposition, triage to disposition, and triage to MD assessment
 - Diagnostic turnarounds
 - Time from inpatient orders to bed placement by unit and acuity
 - Number of ER boarders, patients leaving without being seen (LWBS), and patients leaving against medical advice (AMA)
- The new solution design for the operation needs to include:
 - Resolution of problems
 - Opening access to the right information
 - Technical interfaces between applications
 - Construction of needed data marts to open access to data
 - Process-oriented performance measurement with feedback to support continuous improvement
 - Advanced operational reporting using a dashboard to summarize information and provide alerts

Optimizing Bed Management

Optimization of any activity must begin with a definition of optimization as it applies to the context of that operation. As such, any definition has a narrative description of the concept and a set of characteristics that can be used to identify what optimization or any term looks like in the context of the operation. These characteristics eventually form the foundation for measuring an optimal state and are of critical importance.

Optimal Bed Management can be defined through a set of characteristics. These include:

- Formal, articulated, hospital Bed Management goals that tie to patient safety and satisfaction, and financial management
- A formal Bed Management process that is visible to all involved and where everyone knows his or her role and how the process functions
- Formal Bed Management standards that tie to activity completion points in the process
- Formal Key Performance Indicators (KPIs) that align to key points in the Bed Management process where errors are common, work delays happen, or hand-offs occur
- Formal KPIs that tie back to patient safety indicators and patient satisfaction surveys
- All application systems involved communicate in real time
- Bed Management procedures (automated and manual) that predict availability, coordinate room/bed sanitation, and that release the bed for use in a timely manner as defined by formal hospital standards
- Point of notification data entry that starts the bed assignment process - from registration, ER, paramedic calls, ambulance calls, etc Application systems that deliver all relevant patient information from all hospital applications to the point of entry(Registration, E/R or associated clinic, etc)
- Placement of the patient in the right nursing unit based on condition and physician (adherence with hospital guidelines in patient-bed placement)
- Proper workload balancing and management in all Bed Management support services - cleaning crew, transport, nursing unit notification, etc. - tracked and evaluated based on hospital standards

Optimization must occur at two levels in the operation. The first of these levels is the process level which is a cross-functional or cross-organizational survey of everything that is part of the Bed Management process. The second is within each of the business and clinical units that perform parts of the Bed Management process.

Both these levels must be considered because it is quite possible to optimize at the process level and cause serious work flow problems in the business and clinical units. Optimization is thus a balancing between both levels. For this reason, optimization requires an iterative approach to redesign. Using BPM tools, iterations can be created and tested quickly. But even without the help of these tools, ideas must be tried and creativity promoted to get the best possible solution.

Optimization also takes on different meanings based on the perspective of the person defining it for the operation. An example is the difference between the financial perspective and the quality perspective. For this reason, the definition and components of an optimized operation need to be formally agreed upon by everyone involved in determining when an operation is optimal. This definition and the component parts that describe it are the foundation for performance measurement. Without this, formalization opinions differ and results of performance measurement are open to interpretation.

Once identified and defined, it is necessary to determine how each of the characteristic components fits into the workflow of the operation. This understanding provides the context and shows how the component can be measured. It also shows the places in the activity that contribute to the measurement and lets the team know how the volume, time, quality indicator, etc., that are measured for the component will build. This is the key to creating a measurement formula and a measurement warning system - watch key points in the component's measurement and how the measurement builds against thresholds to provide a warning system. In this way, the performance measurement system supports ongoing and real-time reporting against a state that is defined by management as optimal.

Gaining Control

The Infosys approach to delivering optimal Bed Management is a process-based redesign that leverages current applications. This approach uses BPM tools and techniques to first give visibility to the entire process. It pulls component activities from a wide range of operational units and then offers optimization through:

- Process redesign to eliminate operational problems
- Change management to eliminate human resistance to change
- Measurement and performance monitoring to measure and monitor the operation

This approach makes use of advanced process monitoring with real-time dashboards to indicate what is happening at all points in the process and provide alerts based on trends and limits at 'break points' in the process. While discussing performance measurement and optimization, we saw how optimization can be defined as a series of components or characteristics and how those characteristics can be associated with business activities to show how work is building in the parts of the operation. Taking this a step further, we can look at the points in the workflow where the activity has a high probability of breaking. From this, we can define what is causing each type of break and begin measuring performance and limits in order to issue warnings around performance-reaching threshold points.

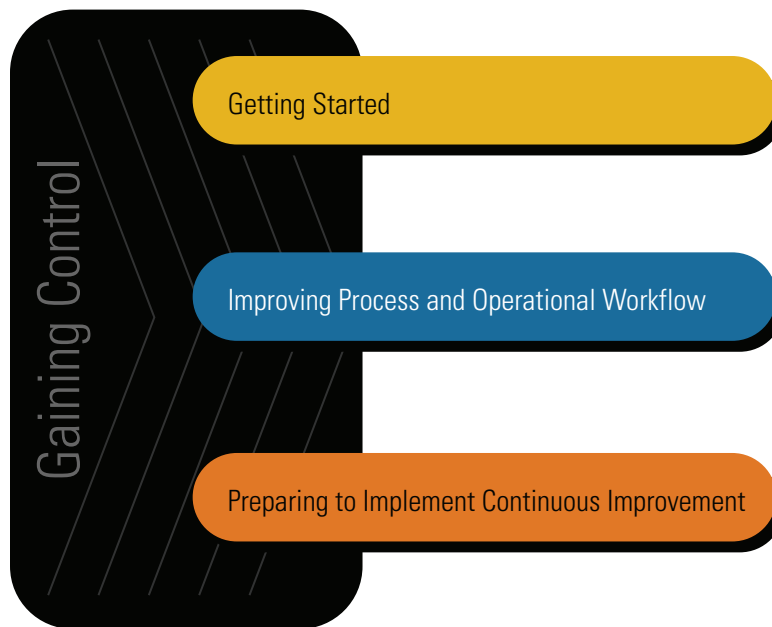
However, this is not an all or nothing approach that disrupts hospital functioning. The approach must be iterative and implementing it must be as non-invasive as possible. Thus, broad-based acceptance must be garnered from managers and staff which is not possible if the fix is worse than the problem. What must be considered is the need for sustainable improvement and this cannot happen through any one-time project - regardless of what the immediate benefit is. History has proven that disruptive one-time improvement efforts are effective only for short periods and the operation evolves back to the previous way of doing business.

To be sustainable, change must be done with people, not to them. The key is not the initial change, although that must also deliver benefit. The key is a change in approach. Once the advantages of the new operation and measurement system are shown as related to their impact on each person's job, a re-orientation to a process-centric way of looking at the operation can begin. This delivers sustainable improvement because it makes improvement a daily activity. It helps managers avoid the introduction of undocumented 'white space' work into the activity as workers try to adjust to ongoing needs for change.

Gaining control through this operational management approach thus does not require that the entire operation be modeled before improvement can begin. We suggest that the Bed Management process be viewed separately from other hospital operations and corrected alone.

Management can then move on to the next process and simply repeat the approach. If standards for modeling, data definition, etc., are created in the Bed Management project, they can be reused and control simply extends as other processes are addressed using the same approach.

The following activities must be performed to gain visibility and control over this important part of the hospital's operation. While it is possible to follow this approach without the use of a BPM tool, it is not recommended. The amount of work is likely to become prohibitive without automated assistance. Let us take a look at the process of putting Bed Management into action.



Getting Started

1. Bed Management is an activity that spans multiple organization units. It is important to start by creating a complete end-to-end view of all the activities that contribute to the Bed Management process
2. The Infosys team works with the stakeholders to redesign the process first as a 'stop gap' improvement that provides immediate relief by eliminating as many of the Bed Management problems as possible
3. It obtains and implements BPM tools and obtains/writes transformation method and standards
4. The team works with the Bed Management staff and the people who admit patients to create a high-level 'as is' process map of the end-to-end Bed Management process. This identifies the feed points, places where IT is used (touch points), and deliverables that come out of the process (including a patient placed in the right bed)
5. The team creates data flow diagrams to show data collection, access, use, transformation and source system
6. It identifies all major problems with the current process and the magnitude of their impact
7. It identifies opportunities for immediate improvement (the low-hanging fruit as it were) and obtains implementation approval
8. Next is the designing of immediate improvements and obtaining acceptance from those involved
9. The team then deploys immediate improvements and measures the improvement
10. It identifies a significant issue or problem from the Bed Management process and creates a pilot project. This allows hospital managers and staff to become familiar with the business and clinical transformation methods and techniques. Importantly, mistakes, if any, are made in a controlled and limited part of the operation

The team then moves on to a more fundamental redesign of the process using BPM tools as technology support. This stage can also involve the leveraging of current legacy applications. This is done to support overall improvement and implement ongoing monitoring / measurement to evolve towards sustained optimization. We now take a look at how process and operational workflows is improved by the Infosys team.

Improving Process and Operational Workflow

1. Define the high-level, cross-functional 'to be' process maps - indicating how to eliminate all problems, points where errors are introduced, stall points, decision points, application touch points, etc.
2. Define the business and clinical unit workflows that include Bed Management work and create a detailed activity-level new design. Optimize the process and business or clinical units' workflow
3. Identify all legacy and new applications that are involved in the new operation and their relationships
 - a. Order in the workflow, interaction (integrated by the package, or interfaced), data quality problems, function support, functional deficiencies, access limitations, etc.
4. Create detailed data flow diagrams of what data is used, where, its source, how it flows from application to application, and how it transforms as it moves through the new process
5. Define what data is available and when - data collection and update cycles - especially for batch systems. Design all interfaces from the legacy applications to the Enterprise Application Integration tools (EAI)
6. Redesign the rules that govern activity at a detailed level and define all application change requirements and new functionalities in the way the process is operated, managed, monitored and controlled
7. Determine if the current applications can be changed or if a new application needs to be built
8. Design dashboards and build interfaces to all data bases - begin to monitor the process

Once the design is completed, the team is in a position to build the new operating environment - process, workflows, applications, interfaces, reports, dashboards, etc.

This delivers an optimal design. However, for financial, political, cultural, and other reasons, it may not be best to move directly to this design. In some cases, it is more productive to create a roadmap that builds to the full design through bite-sized improvements. The key in this construction is to avoid overkill. We suggest that the operation evolves through groups of financially responsible improvements. Each of these improvement evolutions must, however, deliver significant benefits. If the business case for an improvement does not deliver enough benefit, the scope is wrong and it should be rethought.

For example, it may be best to initially find out what is causing the most serious patient-related problems and correct the process and workflows accordingly. As part of this, performance measurement and problem warning alarms can be easily built into the new operation. Once this is in place, the next step of eliminating delays or financial issues can begin. The sequence must be individualized to the needs of the Bed Management process within a hospital. By creating a new high-level design and then building it through a series of detailed evolutions, the focus can be on high-value improvement while ensuring that the operation is not forced to absorb unacceptable costs of disruption. The following points discuss how the process allows continuous improvements:

Preparing to Implement Continuous Improvement

1. Enter rules into the Rules Engine
2. Create all data and function-level interfaces to the current applications
3. Plan, construct and implement all new operation capabilities (business activity and IT applications)
4. Build any new data warehouse capabilities and load data
5. Generate the BPM process management and operation applications
6. Live test the operation (processes and scenarios) and the dashboard reporting
7. Train staff and test their proficiency
8. Begin process monitoring - this tells managers if the staff is following the new process and using applications properly
9. Make adjustments based on measurements

In designing and delivering the new operating environment, we suggest that the team fully engage the people who will use the new approach. Not only are they critical in creating workflows, screens, data flow, data transforms and functional requirements, but also in defining what to measure and how to measure.

Ongoing improvements should be built on the models and information placed in the BPM tool. This provides a common design and application generation platform for all future changes. In approaching this ongoing improvement analysis, a wide range of techniques can be used, depending on the level of technical sophistication at the hospital's command and its change management group.

SUMMARY

Bed Management is a critical core activity in any hospital. When it is either ineffective or inefficient, problems ripple throughout the operation.

In this paper, we have introduced an approach to improve Bed Management. This approach begins with the creation of a comprehensive understanding of how it really works as a process. From this perspective, it is necessary to consider all the activities in any part of the organization - from admitting to house-keeping to finance - that are part of the broader view of the process. By mapping the activity and flow, adding the applications that support each activity and the flow of information, and defining the problems and their causes, the improvement team can redesign the operation and create an optimal new design.

Using BPM technology, it is possible to generate new applications to fill in gaps in the current support and to leverage legacy system support. By creating an evolutionary improvement deployment plan, the most significant patient problems can be addressed first and then, within the context of the overall design, additional groups of problems can be eliminated.

Using web-based portals and advanced dashboard reporting, a flexible reporting system that measures ongoing performance and provides a real-time warning system of possible problems can be added.

Together, these components provide immediate, highly focused improvements for maximum benefit. They also allow the management to evolve the operation toward continuous improvement.

About the Authors

Dr Ramachandran Balaji

Dr Balaji is a Principal Consultant with Infosys and has practiced pediatrics, and run pediatric hospitals and Level III intensive care units. His experience spans a diverse range of technology evaluations and deployments, ranging from IT infrastructure, databases, operating systems, and development platforms to HIS, EMR and Clinical Decision Support systems. He has led the development and implementation of innovative and cutting-edge clinical information systems and Clinical Decision Support systems in Singapore.

He holds an MBBS, DNB (Family Medicine) with an Advanced Post Graduate Diploma in Technology and Systems Management from India.

Mark Brownlee

Associate Vice President, Insurance, Healthcare, and Life Sciences Business Unit at Infosys. Mark Brownlee is now leading the Provider Sector. Prior to joining Infosys in 2003, Mark was President and Founder of The M.W. Brownlee Capital and Management Corporation, a consulting and investment firm focused on CRM strategy. He has also worked for Price Waterhouse Coopers, Pannier Corporation, and Goodyear Tire & Rubber.

Mark holds an MS/MBA in Industrial Administration and BS in Mechanical Engineering from Carnegie Mellon University.



For more information, contact askus@infosys.com

About Infosys

Many of the world's most successful organizations rely on Infosys to deliver measurable business value. Infosys provides business consulting, technology, engineering and outsourcing services to help clients in over 30 countries build tomorrow's enterprise.

For more information about Infosys (NASDAQ:INFY), visit www.infosys.com.