Simulation Modeling for Healthcare Leaders and Planners

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Before a healthcare facility embarks on a project such as a ground-up addition, or department expansion such as Emergency, Surgical, Imaging, Labor & Delivery, Cancer Center they could determine quickly, with relatively minimal expense, in the planning process if their needs and goals will be met as planned and/or, if an expansion is really necessary. Adequate space, quantity of rooms, wait times, bottlenecks and throughput, staffing need’s, are all areas which can be identified and evaluated long before plans are developed; not to mention adding credibility to the financial justification of a project and the Certificate of Need.

Simulation Modeling serves as an optimization tool and exercise which replicates, dynamically over time how certain operations / processes, spaces, staff, equipment, and valuable resources are going to perform and be utilized. Modeling offers the capability and flexibility to adjust variables, and evaluate the impact of these adjustments prior to committing capital to a project.

Using simulation modeling, designers, hospital leadership, facility managers, medical and strategic planners can accurately cycle through an unlimited number of ‘what-if’ scenarios until the optimal balance between operational and planning / design needs are achieved.

For many, the modeling exercise is similar to having a “crystal ball” which enables users to view past, current, and future operational outcomes, simply by adjusting variables such as case volume, schedules, staff, quantity of rooms and equipment, and other resources. For one major academic medical center in downtown Chicago, Illinois simulation modeling was used on their Diagnostic Imaging Platform which highlighted a bottleneck in the planned centrally located Prep / Hold / Recovery area - would have negatively impacted throughput on this platform. Additionally, the exercise identified several underutilized pieces of equipment including an MRI and PET-CT resulting in significant cost savings.

What are the ingredients?
By far the two most important ingredients are hospital Leadership Support, and Clinical Participation. Developing a well-illustrated Process Flow Diagram which captures at least 90-95% of the patient flow
through a particular department is critical to the success of the model development. It should be noted, process flow does not warrant having a design in hand nor does the flow diagram itself need to be overly detailed and precise, it is purely a graphical representation of how a patient moves through a department / area from beginning to end.

Another important ingredient is setting **Goals** which will later help to manage expectations. Goal setting could be linked to strategic planning which projects future patient volumes or utilization rates for certain resources (such as an OR), or reducing wait times in the ED.

**Data** can be a bit of a challenge, nevertheless it is a critical ingredient which literally “feeds” the model—remember “garbage in, garbage out”. Ideally, we look for at least 1-year worth of historical data given the trends and possible season / weather changes which occur throughout a year. When speaking about modeling a department, data relates specifically to patient volumes, time and procedure / modality. Accordingly, we need to be able to time stamp a patients movement from the time they first enter a department to the time they exit. Data availability and accuracy varies widely amongst hospitals, departments, and states however, all is not lost when it is not available. A data set can be built from sources including department staff and statistics, past experiences, industry organizations, state data base, and combinations.

The final ingredient is having the right **Software** to run the model. Readers beware; modeling software is not out of the box plug and play. When considering a software do your homework, ask lots of questions and for references specific to hospital models, plan on a training program before using as well as committing time to learn the software, and don’t be deceived by fancy graphics capabilities.

**What are the steps?**
Some of the steps are outlined below, however it is important to realize that every hospital and healthcare system has unique philosophies and cultures which play a major role when embarking on a simulation modeling exercise - it is very liberating because it brings into focus not only how you conduct business but, the many challenges and obstacles you face in conducting business which ultimately prevents an organization from optimizing their performance.
Form Team:
- Champion is typically a department leader or someone empowered by them, perhaps a member from the planning department working closely with leadership
- Planner / designer
- Stakeholders especially the clinicians working in the trenches on a daily basis
- Modeler

Identify Goals & Assumptions:
- Right size space
- Improve resource utilization
- Identify bottlenecks
- Improve throughput
- Validate systems functionality
- Hours of operation
- Room turn-around times
- Block schedule or not

Assess Results:
- Ask yourself and the team “do the results make sense?”
  - Review durations
  - Review utilizations
- Leverage the experience of the team
- Compare against existing operations
  - Visit the department and observe
  - Discuss with clinicians

By this point, you probably have many questions which could be answered in the list of FAQ’s.

Is simulation the same as Lean?
- No, simulation is a tool which is frequently used to support and test lean methodologies.

How can it benefit my needs?
- Simulation delivers benefits in many areas including financial, safety, efficiency, capital planning, staffing, equipment, supplies, and space.
Some members of our board are nervous and raising concerns about the forecasted volumes and subsequent expansion needs; is this an appropriate tool to justify and support either way such a program?

- Fortune 500 companies along with public agencies have embraced simulation for this concern simply because it affords them an opportunity to continuously test their businesses operating model. One of the most powerful features and benefit of simulating is the opportunity to trial unlimited combinations of operational scenarios before committing valuable resources and incurring risks.

The CON review board has challenged the projected quantity of some very high dollar service lines and spaces; can it be used for CON?

- Yes, simulation is a scientific tool which delivers precision results unlike traditional approaches which use spreadsheets and averages along with a one day snapshot for volumes.

Can it be used for financial forecasting?

- Yes, there are several ways depending specifically on your needs, for example the model could indicate years in advance when you need to expand or add staff so that you can allocate when preparing annual budgets.

What if my capital program is expected to span over 20 years or more?

- Simulation is a planning tool which can be used 100 plus years if that is your need so long as you have forecasts that far in advance.

Can it be used with a multiphase project?

- Yes, simulation is a very useful tool for multiphase projects because it will provide cause and effect results allowing the user to test as many phases as they need to achieve optimum results.

Can it be used for value engineering?

- Yes, simulation modeling can be used very effectively at identifying a variety of cost saving or deferral opportunities including areas like operations, resources, design, and equipment.

How is it different from BIM?

- Simulation Modeling is a tool used overall to optimize resources and improve performance in a dynamic sense, whereas BIM is focused on design in the static sense.

When is the best time to use Simulation?

- Anytime can be the right time, it just depends on what solutions or results the user(s) are in need of such for instance existing facilities experiencing long wait times in the ED Waiting room are interested in setting an acceptable wait time and then determining resources such as rooms, equipment, staff to achieve this goal.
Can it be used once a project has begun? How? Benefits?

- Absolutely, it can be used at any point before, during, and after completion to identify when (at what point in time) quantities of resources such as rooms, staff, equipment, supplies, and/or financial needs will be required. Why spend money unnecessarily on resources which are not immediately needed resulting in low performance and utilizations. Since often times expansions are based on an immediate need as well as future growth, modeling will identify the specific point in time when resources will be needed; this enables sound management and allocation of capital.

We are considering a merger with a nearby hospital, how can modeling help with our intentions?

- Modeling will identify the optimum quantity of resources including space, staff, equipment, and supplies. It could help with phasing, identify work flow issues, as well as overall operational logistics solutions.

We are considering the acquisition of several hospitals with the eventual merging and a final standalone replacement hospital; how can modeling benefit our goals?

- See answer above for mergers.

We are considering the consolidation of our invasive procedure departments to create an Interventional Platform which would include Cardiology, Orthopedics, General Surgery, Interventional Radiology, Endoscopy, ENT, and Transplant. Can and how would modeling benefit this initiative?

- Yes, modeling could be used when considering any variety of department consolidations. Modeling would essentially identify the optimum balance of between goals and resources for the newly created platform.

How long does it take before we see results?

- Results can be achieved in as little as 2-3 weeks.

Can the model be used for monitoring performance and continuous improvement?

- Yes, once the model has been developed and tested, a variety of Dashboards can be subsequently developed and used by stakeholders to monitor performance along with testing alternative operational scenarios such as shutting down a room due to low utilization, etc.

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