BRIGHAM AND WOMEN'S EMERGENCY DEPARTMENT OBSERVATION UNIT PROCESS IMPROVEMENT

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Abstract

Emergency department observation units (OUs) provide care more efficiently than other care options by targeting specific emergency department patients. Managed appropriately, OUs lead to shorter patient stays and lower system costs. Based on literature, observation, and data from Brigham and Women's (BWH) and other hospitals with observation units, the team has developed a tool that accepts facility-specific data, performs a variety of computations, and produces recommendations to optimize operations. Measures common to all OUs are entered into the tool which utilizes integer programming, Monte Carlo simulation, and other analytical analyses. These data help guide decisions regarding unit size and staff scheduling, as well as providing feedback on unit performance metrics. The team worked with OU managers to verify and validate the tool through testing with data from BWH. The primary goal is to provide OU management with information to help them make better-informed decisions that will improve patient care, population health, and costs.
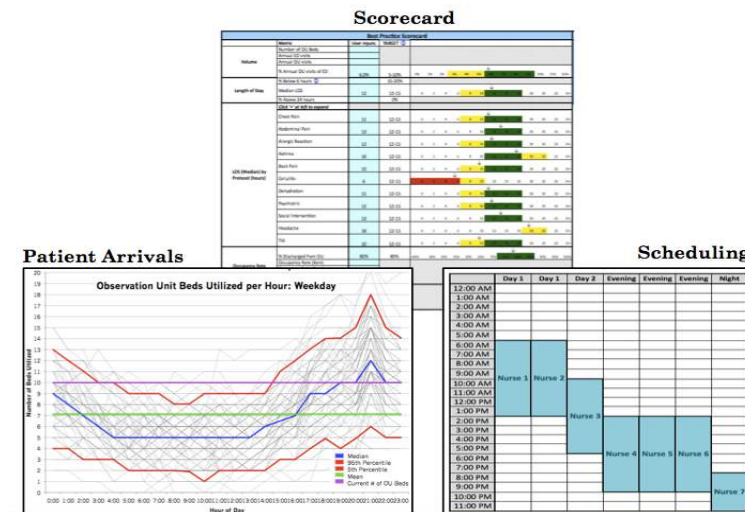
Screen captures of outputs

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The Need for Project

Emergency department observation units are challenged with operational decisions including: unit staffing, unit capacity and operational assessment.

Emergency department patients become OU patients if their condition is such that they should not be admitted to the hospital, but are unsafe to send home; the OU allows them access to care for an addition 8-48 hours (Rep. 3.3). In addition to improving patient care, OU's save hospitals money because they are less expensive than either remaining in the ED or short impatient stays (Rep. 2.2). The team's objective is to optimize the operations of these units by providing decision support through a universal tool to assist in determining: staffing levels, the number of beds available, and a way to assess overall unit operational effectiveness.

## The Design Project Objectives and Requirements

The objective of this project is to improve the operations of any observation unit by providing OU managers a decision-support tool to help measure, improve and monitor unit performance.

Design Objectives

To improve OU's, this analytical tool will generate recommendations based on generic OU variables with facility-specific inputs to optimize the number of beds, staffing, and provide best practice targets. By determining improved operating levels, the goal is to better hospitals' overall performance by focusing on the objectives of the Triple Aim (Rep. 4.2).

Design Requirements

Currently, it is challenging for OU's to assess how well the unit functions in terms of scheduling staff appropriately, determining the correct number of beds, and deciding when to increase unit size or add an additional unit. Brigham and Women's Hospital observation unit is the project sponsor and test site. The BWH OU is comprised of 10 beds, all of which are generally full by 11PM, causing doctors to send patients elsewhere. Currently, the unit is staffed at a set 5:1 patient to nurse ratio (2 nurses) and a 10:1 patient to medical assistant (1 MA) at all times. In this type of unit, patient length of stay should average 15 hours, but at BWH the average is 10 hours with 35% of patients staying 6 hours or less (Rep. 3.2) To increase efficiency, OUs need to be aware of their current operation levels, and have the analytical power to find improvements.
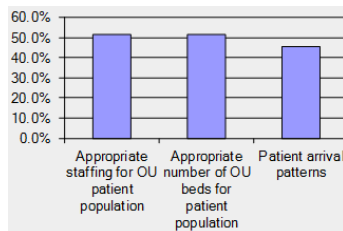
Most Useful Analysis for
OU Managers

Design Concepts Considered

OU managers are the people who best understand the operational challenges of making an OU more efficient; thus, the team turned to them to identify challenges, analyses and software to best support their decisions.
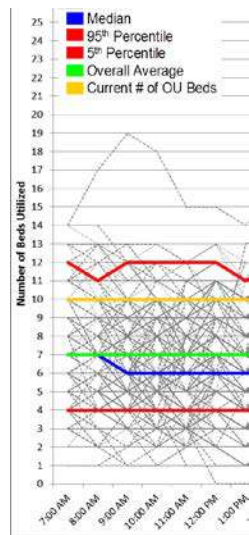
Graph of Patient Arrivals

To determine what challenges, analyses, priorities, and software would be most useful to OU managers, the team surveyed OU managers (Rep. 5). Operational challenges that units experience include patient length of stay, over or under-utilized beds, staff levels, staff scheduling and patient selection. Responses collected from managers indicate that staffing levels and underutilized beds are two of the most important issues. Some other challenges managers identified include patient selection and inpatient boarders occupying beds. These decisions are either a challenging medical decision or an overall hospital logistical problem, both of which are beyond project scope and team ability. OU managers also replied that the analyses that would assist the most with operational decisions are: staffing to patient populations, unit size, and determining patient arrival patterns. Managers also identified Excel as the best software base for this tool, likely due to its universality, while the team was considering a more flexible and inexpensive freeware.

For any OU problems to be solved, they must first be identified; the team decided to develop a score card to help managers see how their units are performing and identify where they can improve. Observation Units are still an evolving medical concept, so it is important that goals are identified and understood.

Recommended Design Concept

The tool design is intended to best support OU manger decisions by providing a clear vision of what is currently happening in the OU and recommendations for improvement.

Design Description

The basic concept of the entire OU analysis tool is to take inputs from any OU, analyze the current state of the department, and perform calculations to determine optimal values for different variables. Data requirements include: patient arrival and departure times, nurse to patient and MA to patient ratios, nursing shift times, and assorted performance metrics. After analytical analyses are performed, the tool provides information to guide operational decisions.

To determine the number of beds a unit should have, a graph of the hourly median, 5th and 95th percentiles as well as the overall average number of patients is provided. Managers are also given a chart of bed utilization percentages throughout the day for different unit

sizes (Rep. 6). For staffing, the tool provides visual schedules that show the number of nurses and MAs recommended for shifts on weekends and weekdays, and their utilization percentages by hour (Rep. 7). Finally, the scorecard provides both numerical and visual feedback on how a unit is doing compared to ideals, as well as information on how and why these metrics are calculated (Rep. 8).

Analytical Investigations

Analysis of Patient Arrivals & Unit Size

This component of the tool uses patient arrival patterns and length of stay distributions to determine the optimal number of beds for an observation unit. Users input the average and standard deviation of the number of patients who arrive each hour of the day and the probability distribution of patient lengths of stay. This data is used to generate a "day" of patient arrivals with a negative binomial distribution to create a possible scenario of patients arriving in each hour for a day, assuming infinite beds are available (Rep. 6.2). Aggregated values of 100 simulated days provide information to decide how many beds should be available at any given time (Rep. 6).

Nurse and Medical Assistant Scheduling

To determine the optimal number of nurses and MAs to schedule for weekends and weekdays, the tool uses an integer program. OU managers first input nurse to patient ratios, MA to patient ratios and estimates of staffing costs. Data from the analysis of patient arrivals and unit size is used with provided ratios to calculate the minimum number of nurses that should be staffed per hour. The objective of the model is to minimize the overall cost of staffing while appropriately meeting patient demand; this is determined by the sum product of cost per shift and the number of staff per shift (Rep. 7).

Observation Unit Metrics & Scorecard

Observation unit managers can enter values for a number of operational metrics, as well as identify how these metrics are calculated, what optimal values are, and the logic behind the selected optimum. Descriptions are provided to guide OU managers through metric calculations, and when values are entered, visual feedback is provided. OU managers need to know how their unit is performing to identify areas for improvement (Rep. 8).

To perform the analytical analyses and calculations, the tool uses Monte Carlo simulation and integer programming to interpret current-state data and then output improved values.

Visual Nurse Schedule

Key Advantages of Recommended Concept

Advantages of developing and implementing this decision support tool include: low overall cost, high potential for impact to the Triple Aim, and potential for future expansion, improvement and research.

This decision support tool provides the combination of low initial investment of time and money with high potential for impact to both patient care and cost. Because of the universality of the problems OUs face, the team is by extension able to assist any emergency department observation unit. Analyses provided meet the top 65% of the information requested by OU managers to make improved and effective operational decisions.

Financial Issues

Access to Microsoft Excel is the largest financial issue, followed by the time and effort necessary to obtain sufficient and accurate data.

The tool was designed and created in Excel to minimize financial issues with purchasing and downloading software. Most users are anticipated to already have Excel, although as the team discovered it must be able to function in earlier versions of the Excel to accommodate technology limitations. Consequently, all Excel versions 2003 and later are fully compatible with tool functions. Another financial consideration is time required to collect data (if IT cannot provide it easily) and the time managers must take to familiarize themselves with the tool. Data needs were considered and minimized, but may still be a barrier to some hospitals.

Recommended Improvements

There is high potential to improve this tool to increase accuracy and provide additional useful analyses. Some of the highest potential improvements are adding layers of complexity, analyzing each day of the week separately and a method to compile OU data to drive other research.

1. Increase model complexity to improve accuracy.
2. Analysis of individual days of the week for trends.
3. Develop method for data-sharing so that OU metrics and data, all of which is de-identified, could be used for future research.
4. Method of recommending an optimal schedule for staff as well as how many staff should work each shift.
5. A way of assessing patient complexity and incorporating it into analysis of staffing.
6. More extensive metrics and definitions of success and improvements within the OU.
7. Forecast future patient trends to help anticipate demand changes.

(Rep. 11.2)