VA Endoscopy Utilization

Design Team
Anisa Bregasi, Benjamin Colonna
Gregg Izzo

Design Advisor
Prof. James Benneyan

Abstract
Patient demand for endoscopic procedures is surpassing the capacity of the Jamaica Plains Veterans Affairs (VA) Medical Center Endoscopy Suite. A design team of industrial engineers has diagnosed the suite as having a suboptimal utilization rate due to the high cancellation and no show rates among patients. This results in increasing access times, defined as the length of time between the scheduling of the appointment and the actual procedure, which are currently up to a year in length. The high nonattendance rate also leads to under utilization of staff and resources. Using forecasting, simulation modeling, and cost function optimization, the design team will identify scheduling methods and techniques that will increase the utilization of the suite, allowing for more patients to be examined by the physicians in a timely manner.
The Need for Project

Underutilization of the endoscopy suite has lead to wasted financial resources and increased patient access times causing delayed diagnosis of serious conditions.

Demand for endoscopy procedures in the United States, and specifically at VA hospitals, has been increasing dramatically. Patient cancellations and no-shows are common, and efforts have been made by endoscopy clinics across the United States to prevent patients from cancelling or failing to show up for their appointment. This low patient attendance rate results in an underutilization of the endoscopy suite and leads to increased patient access time and wasted financial resources. The goal of the project is to provide the VA with a flexible plan to effectively deal with their inflated cancellation and no-show rates.

The Design Project Objectives and Requirements

To increase endoscopy suite utilization in a cost effective manner, the high variance of patient nonattendance rates and zero revenue gains of the VA must be accounted for.

95% Confidence Interval of Nonattendance rate

Design Objectives

The objective of this project is to increase the utilization of the endoscopy suite while taking into consideration the VA’s unique financial situation. With increased utilization the hospital will save money and decrease patient access time.

Increasing utilization of the endoscopy suite is a difficult task due to extremely variable attendance rate of the patients at the not-for-profit VA Medical Center.

Design Requirements

The endoscopy procedure nonattendance rate during a three month observation period was 33.79% with a standard deviation of 13.6%.

The suite is considered to be working at 100% utilization when a physician performs 12 procedures during their full shift. The endoscopy suite runs several clinic types: two physicians working full time with capacity \((k) = 24\), one full time and one half day \(k = 16\), one full time \(k = 12\), and one half day \(k = 4\). Each physician has their own clinic, and does not take other physicians’ patients regardless of how many total patients are present.

The optimal room to physician ratio is two or more rooms per physician. The Jamaica Plains outpatient endoscopy clinic never staffs physicians above this level. The project also takes into consideration that the suite has relocation plans which will change the number of rooms from four to eight.
Design Concepts Considered

Five candidate concepts were designed and it was possible to incorporate parts from each concept into our final recommended design concept.

Forecasting Equations

- Volume Weighted Alpha
- Historically Weighted Alpha

Actual Nonattendance Rate vs. Forecasted

Forecasting

Several forecasting techniques were used to identify if and when patient nonattendance rates would increase or decrease. Any trends found could be due to seasonal factors, or the ever increasing access time. Criteria examined for correlation were the time the appointment was scheduled, the procedure type, whether it was a single or combined procedure, and the day of the week the procedure was performed.

Simulation

Early in the project, a simulation model was developed that replicated the performance of the endoscopy suite. Key measures such as which time slots should be overbooked to minimize wait time were able to be established through the model.

Variable Staffing Model

Initial goals of the simulation model included the addition of a variable staff member. This staff member would be a physician who had a morning rotation at the hospital with the potential to be called into the endoscopy suite in the afternoon to perform procedures. This would be done in the event that too many overbooked patients showed up to alleviate the need for overtime costs. It was decided that hiring a new part-time physician is not feasible in the VA system as a result of meetings with hospital executives.

Cost Function Optimization

A cost model was developed to identify the optimal number of patients to overbook. This was done by comparing the cost to the VA of patients not showing up to the cost of too many patients showing up and having to keep the suite open for overtime, while taking into account the nonattendance rate. This model is successful at demonstrating the financial losses of the situation, and is useful for identifying the optimal number of patients to book for certain cost ratios. The cost ratio can be changed according to the VA’s needs.

Cost Justification of Incentive Program

The chief of gastroenterology expressed great interest in reducing cancellation and no show rates. The design team has proposed a cost justification of an incentive program that has been successful in other medical settings. An incentive program would involve rewarding patients with a small gift, or cash prize for attending their procedure.
**Recommended Design Concept**

The recommended design concept maximizes patient throughput with respect to cost while still minimizing patient wait time.

**Design Description**

When considering overbooking strategies at the VA, there are several issues that require a unique approach when selecting the optimal number of patients to overbook. The first factor to consider is that physicians are unable to accrue overtime pay and are not paid on a per procedure basis. This means that when they past the 100% utilization rate, they are working without pay which leads to physician dissatisfaction. Nurses and health technicians, however, are paid for overtime, and all overtime expenses are taken out of a department’s budget. Aside from being used to pay existing staff, the department budget is used to purchase supplies and equipment. This means that minimizing overtime is important for management and department heads at the VA, because having up to date equipment and supplies leads to higher quality of care.

In order for solutions to be implemented as quickly as possible, overbooking of two different staffing situations have been optimized. Both the staffing of one full time and two full time physicians were targeted because with parallel scheduling overbooking, a half day physician has too great a risk of resulting in over utilization.

**Analytical Investigations**

**Expected Loss Function**

Interviews were conducted with the staff members to gain insight into the waste of resources related to patients missing their appointments. This includes the nurses being underutilized, and the health technicians either not having procedure rooms to prepare or having to re-work materials.

Considering that the VA receives no revenue in performing a procedure, there is little motivation for them to risk depleting the budget with overtime expenses. To justify an optimal number of patients to overbook, a financial ratio is presented to the VA for several different attendance rates. This ratio of dollars lost per empty slot to dollars spent for overtime can be selected and modified by the VA to adjust for the other risks not associated with actual costs, such as physician dissatisfaction, or increased patient wait time. Expected losses were calculated using ratios from 1:1.5 up to 1:10.
Incentive Justification

The expected loss function was analyzed, and modified to solve for at what percent increase in attendance an incentive program is cost effective. The design team can present the VA with all the needed data to measure the effectiveness of an implemented incentive program. The graph to the left illustrates the proposed reward of ten dollars, which requires an improvement of exactly 15.44%, anything less would result in a financial loss.

Experimental Investigations

Time Slot Optimization

The decision was made to shift our simulation model from justification of an on-call physician to an illustration of the benefit of switching from one hour procedure blocks to half hour blocks in order to decrease patient wait time. After this was verified through the simulation model, it was used as a decision-making tool to show what the optimal time slots are to book patients so that they can effectively minimize patient wait times in the clinic.

Changing Scheduling Methods

Currently the endoscopy suite uses a parallel scheduling method where each physician has their own patients. With extremely variable patient attendance patterns, this kind of scheduling method frequently results in an unbalanced workload between physicians.

Switching to a single queue scheduling method not only decreases wait time as proven by the simulation model, but it also allows for a safer increase in overbooking because it reduces the risk overtime. For example, in a parallel queue if physician 1 has 13 patients show up, and physician 2 only has 11 patients show up, we have wasted one time slot, and require one overtime slot. With single queue both physicians have 12 patients, achieving 100% utilization.

Key Advantages of Recommended Concept

The optimization strategy is linked directly to the cost function so that the VA can choose the expected expenditure to savings ratio that they feel comfortable with. Multiple cancellations and no show rates have been included so that if patient behavior starts to trend in a different direction they have the ability to adjust the number of booked patients accordingly.

Another advantage of this strategy is that with simple data
analysis of a new patient population, this solution can be transported to other outpatient endoscopy suites within the VA system, or other medical clinics with high nonattendance rates.

Financial Issues

The cost of the recommended design concept will be minimal until the implementation of the incentive program. Every recommended solution will cost the hospital capital expenditure. Overbooking patients will not result in losses until too many patients show up, and staff members are required to work overtime. The value of these strategies is the potential costs savings. In the VA’s situation it is difficult to quantify benefits of overbooking or incentives because there is no revenue generation.

Incentives, although justifiable, offer no guarantee that they will motivate patients to meet their appointments. Analysis must be done to verify that the cancellation and no show rates are decreasing during their implementation.

Recommended Improvements

Demographic research for types of incentives, and continuous data collection are imperative for success. A thorough investigation into the incentive program needs to occur. While the design team is able to define how much the hospital should allocate to the program during the initial phases, the specifics of what type of gifts, vouchers, or other incentives that would entice a patient to show up for their procedure has yet to be specified. The purpose of the incentive is to create additional value for the patient to come into the hospital, while reducing the risk of too many patients showing up which leads to overtime expenditures.

More sufficient data must be gathered on cancellations before and after the exact point at which a procedure cannot be rescheduled with another patient. The drawback of the manual data collection method is that it was impossible to get the date that a patient called to cancel their appointment.

With continuous data collection and longer periods of observation, the VA may be able to identify trends in the future that can help more accurately predict when the cancellation and no show rate is about to change.