Abstract

Harvard Vanguard Medical Associates (HVMA) is a leader in the outpatient healthcare industry. The organization has been in business for over 50 years, and has grown dramatically throughout eastern Massachusetts. The growth and evolution of the business has also led to new innovations and the need for constant improvement. Currently, the Obstetrics and Gynecology (OB/GYN) department within HVMA is experiencing process variability and high costs in their processing of laboratory results. Lab results arrive on the Epic Electronic Medical Record (EMR) system; the clinicians, nurses, and medical assistants then interact with the system to determine how to notify the patient of the results. However, there is no standardized workflow to process these results and inform the patient. The lack of standardization is causing discrepancies, tardiness, and unnecessarily long turn-around times for labs. This ambiguity results in many repercussions; clinicians, for example, spend vast amounts of time trying to process the lab results, hence decreasing their availability to see patients. This translates into clinicians not working to the top of their license, which translates into capital loss for the organization. In this design project, the aim was to utilize industrial engineering methodologies to create and implement a standardized workflow across all 14 OB/GYN departments. The team collected extensive system data to analyze and input into a simulation to perform sensitivity analyses to identify changes that would significantly improve the system. Improvement was measured by the total number of “touches” the staff experienced and the overall utilization of resources available. This project aimed to reduce the variability across the organization and inherently increase the productivity of the clinical staff and improve stakeholder (clinicians, nurses, medical staff, HVMA, and customers) satisfaction.
The Need for Project

Clinicians across HVMA currently have no standard workflow to process labs resulting in duplication of work and increased turnaround time for the patient. Currently, the OB/GYN department across Harvard Vanguard Medical Associates has no standard workflow to process lab results. Clinicians and medical staff are completing labs inconsistently, repeating steps in the lab completion process, and ultimately increasing turnaround time for the patient. Waste is a major issue within the healthcare industry and reducing the waste of time by minimizing lab processing will free up staff to perform critical, value added tasks for patients. Our project defined a process that can be utilized across Harvard Vanguard clinics to decrease the number of staff members who touch each lab in order to achieve a streamlined workflow and improve the overall efficiency of the staff members.

The Design Project Objectives and Requirements

The objective was to develop a new standard workflow that could be applied across various sites to reduce turnaround time and increase office efficiency.

Design Objectives

The objective of our project was to map out the current process at five of Harvard Vanguard’s medical offices in order to determine the best way to improve the lab processes across the system. Our focus was to decrease the number of touches for each lab by clinicians, nurses, medical assistants, and medical secretaries from the moment the lab is received in the clinician’s In-Basket. Clinicians, then nurses, have the most valued added input to the system. Freeing up time for additional patient interaction was a key objective in reducing touches. Our scope only included the OB/GYN department at each site and only affected the lab completion process once the results were received to the health provider’s In-Basket.

Design Requirements

Our project design needed to be flexible enough to be implemented across various medical sites while robust enough to significantly impact the way the lab was completed. The new workflow depicts the real system we were improving and shows how it differs from the old one. These changes could then be applied as long as we had commitment from every member of the team and a way to monitor progress to confirm process improvement. The offices required a clear and simple facilitator that would map the new process and included jargon that all staff members could understand.
Design Concepts Considered

Six initial design concepts were considered and weighed against each other based on site visits. Three of these concepts were combined and modified to fit the goals of the project.

With the initial visits to five Harvard Vanguard sites finished, analysis of each office was taken into consideration and different methodologies for analysis were discussed. A table was put together that listed the benefits of each of these potential choices. After analyzing and defining the scope of the project, it became clear which concepts would be the most applicable.

Lean methodologies were the first methods to be investigated. These methods would help in a route cause analysis of HVMA’s process and potentially allow for the removal of any identified non-value added steps. Even though these lean methodologies will be a crucial theme to maintain throughout this project, it is not the primary direction the project will follow. Constructing an A3 report provided a nice summary of the identified problems in the process and a written route cause analysis.

Designing a simulation using Arena programming was a method that was considered from the beginning. With information from doctors and clinicians, a process flow chart could be modeled. With these processes and collected data, process times and arrival rates could be applied to a simulation. This provided confirmation of a hypothesis before actual testing and implementation. The simulation will provide output measures that show improvement and will allow forward progress in implementation across Harvard Vanguard.

There were opportunities to utilize queuing models, and analyze how the labs arrive and leave the process. Queuing would have provided a state of the current process but not a solution. The biggest issue faced with a queuing model was the lack of data available from Harvard Vanguard. With much of the data being confidential, access to it is hard to come by. Likewise, facility layouts and human factors studies were also considered approaches for this project. While facility layouts could be used to model a simulation, it is not applicable for electronic lab reports and therefore was not directly utilized. Human factors were considered as far as human interaction with electronic medical records, but quantifying these interactions proved to be outside the scope of this project.

Through comprehensive studies and weighing the benefits and constraints of each idea, the decision was made to construct an A3
overviewing the project, use design of experiment to design effective
testing of a standard workflow, and design an Arena simulation model
to perform sensitivity analysis on the system.

**Recommended Design Concept**

**Developing standard workflows and defining responsibility** will reduce the number of touches on labs while balancing out the utilization rate among the employees.

The recommended design concept has been developed following a process of data collection, careful analysis, and testing. The team constructed a robust but efficient data collection sheet, see Figure 2, in order to gather data to determine the arrival rate of labs to the in-baskets, the number of touches performed, and the action taken for each touch.

![Figure 2: Data collection sheet utilized by the clinicians when processing lab results.](image)

The collected data provided inputs to a digital simulation model in order to model the current state of the system. A sensitivity analysis was performed on the model to simulate the effect changes would have on the performance measures: the number of touches per day and balanced utilization of employees.

Additionally, the team met with physicians and worked to develop a standard work flow for several types of labs, see an example in Figure 1. The new work flow established standard work and reduced variability in lab processing. This improvement required each physician to have a medical assistant monitoring their in-basket at a minimum of twice a day. The medical assistant will work to clear out the defined key labs, following the developed workflows. The new process for these key labs involved the medical assistants to only triage labs with normal results, allowing a licensed clinician to analyze any abnormal result that needs medical attention.

Finally, we utilized these workflow processes to develop an improved model in Arena. This model proved that we were able to increase the utilization of medical assistants while decreasing touches and utilization for physicians, freeing up more clinician availability time.
**Financial Issues**

The design and analysis came at a minimal cost to both Northeastern University and HVMA and has a great potential to gain a fast return on investment. Design costs, which were minimal in this project, included transportation and employee time. The team spent a vast amount of time traveling to multiple offices across eastern Massachusetts to conduct interviews and gain insights from many perspectives in order to gather enough information to conduct a thorough analysis. Associated with these interviews was the time spent with clinicians, nurses, and medical assistants. These interviews ranged anywhere from fifteen minutes to an hour. According to the Bureau of Labor Statistics the average salary of obstetricians and gynecologists in 2009 was $204,470. An hour of their time cost an estimated $80. Future financial needs will include the cost for HVMA to continually assess and reevaluate the workflows for specific lab types (Pap Smear, Cholesterol, Mammograms, etc.) to ensure they are up to date with medical standards and HIPAA compliance regulations. The return on investment seen from this project has great potential to increase HVMA’s revenues by increasing effective utilization of their licensed clinicians and nurses, and decreasing wasted time on labs.

**Recommended Improvements**

Future work should include an iterative review of the workflows and expansion of the project to all 14 HVMA OB/GYN sites. The project has two main areas for future improvements: expansion of standardization to encompass more lab types and iterative reviews of existing lab workflows to utilize all functionality and maintain regulatory compliance. The expansion of this project to include standardization of all the lab types contained within the OB/GYN department would show a drastic improvement in decreasing the number of touches per lab. Also, expanding this solution to be a HVMA standard would allow for all 14 OB/GYN departments to implement it. These organization-wide improvements could have large cost benefits for HVMA. Similarly, HVMA must be continuously iterating the workflows and refining them to ensure that each test is handled properly and is both medically accurate and follows patient notification compliance regulations. Both of these factors, if followed, will allow for continued certification and will also have a positive collateral effect with the population of patients being served.