Ambulatory Clinic:
Schedule attainment and staff profile harmonization

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Abstract
Boston Medical Center, located in the south end of Boston, is the largest safety-net hospital in New England. As part of its mission to serve the surrounding communities, the medical center offers several levels of care to elderly patients through the Geriatrics Department. Among these offerings is the Geriatric Ambulatory Clinic, which provides outpatient care to patients over the age of sixty-five. Through literature research, clinic observations and data collection activities, interviews with clinic staff, and subsequent analysis of this information, the clinic’s current state has been defined as having inefficient processes which have led to the inability to meet growing demand for care.

Any proposed solutions, must meet the success metrics of percent on-time appointment attainment, average patient time in the system, and average patient wait time to quantify the success of improvements. These measures coincide with the Triple Aim of healthcare to improve the quality of care delivered, increase the satisfaction of patients, and decrease overall cost. In order to improve the current state and successfully meet growing demand, Industrial Engineering techniques, including time studies, statistical analysis, simulation models, and process maps, were used to develop solution paths that have been proposed for implementation in order to increase the efficiency and effectiveness of the clinic. By implementing lean concepts and reallocating clinic roles to eliminate overlapping staff responsibilities, the geriatric clinic will streamline processes and optimize the clinic’s staff to increase throughput and accommodate the growing patient demand.

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The Need for Project

The patient visit volume for the geriatric clinic at Boston Medical Center (BMC) has grown in recent years, but number of clinic support staff has remained constant. For fiscal year 2012, the clinic witnessed a 9.5% increase in total visit volume over the previous year. With more patients visiting, process inefficiencies have caused an over-utilization of staff members, increasing wait times and levels of stress within the clinic. Providers feel that the overall quality of patient care has diminished as they feel rushed to successfully finish all of their scheduled appointments (appts). Given these issues, it is essential for the geriatric clinic to implement feasible, low cost solutions to accommodate growing patient volume, while providing high quality and effective care to patients.

The Design Project Objectives and Requirements

Design Objectives

The objective is to alleviate resource strain within the clinic and successfully accommodate a growth in the number of patients. The team has defined the problem statement as follows:

Measure and quantify the utilization of current staff resources in the Geriatrics Ambulatory Clinic to: a) develop a solution so that the current and future demand can be met. b) harmonize clinic responsibilities with the staff’s level of expertise.

Design Requirements

The design must accurately reflect the clinic’s current policies and continue to deliver high-quality, patient-centered care. To do this, patients should continue to be seen by a doctor or nurse practitioner, which also allows the clinic to bill for the appt. At the same time, the provider utilization percentage is to be reduced from the currently high 84%. This calculated baseline agrees with provider’s comments about stress resulting from the busy schedule, and any solutions should lower this high utilization. As the clinic currently serves walk-in and late patients, the design must continue to do so as well. The total visit time should not be increased from the current range of 51 to 120 minutes. The delivered design should improve schedule attainment from the currently calculated 21%. Overall, the design should improve patient care, result in better health for all, and decrease costs.
Design Concepts Considered

Data analysis revealed that a highly variable patient arrival pattern leads to clinic delays. Through statistical analysis, digital modeling, and problem solving, solution sets must be developed to improve clinic performance.

Analysis of collected data revealed a high level of variability within the clinic, and patients arriving late were found to have the greatest effect on the system. The deviation between patient arrival time and their appt is normally distributed, with a mean arrival time of 16.1 minutes before the scheduled appt. This early arrival is a good thing; however, a large variance means that 68% of patients arrive between 47 minutes early and 15 minutes late (Rep 5.3.1). During a clinic session, variation from late arrivals and appts that run over their allotted time combine and lead to greater delays and deviation from schedule. See Figure 1 for an illustration of this concept. The design team developed and considered the following multifaceted solution sets to improve the clinic’s ability to operate on schedule and meet demand.

Additional Resources

Solution: Hire additional providers to increase capacity

Feasibility: As BMC is a safety-net hospital, hiring additional staff is not realistic. Also, while hiring providers would increase capacity, this solution would only be effective until the additional provider(s) reached a full patient panel size, as the same issues seen today would arise due to process inefficiencies and sub-optimal work distribution.

Adjusting the Appointment Time to Create a Buffer

Solution: Create a buffer period by creating an altered patient schedule

Feasibility: Currently the appointment time given to a patient is the same time the provider is scheduled to see them. However, a patient needs to check-in and be triaged first, so the clinic asks that patients arrive 20 minutes before their scheduled time. A separate patient schedule, offset from the provider time, would theoretically create a buffer for those patients who arrive later than 20 minutes prior to their appt, but his merely builds in one buffer for the day, meaning one late patient or late appt can negate the effects of the buffer.

Using Medical Students

Solution: Use students to create buffers

Feasibility: Strategic use of students can help create buffers for providers to accommodate the inherent variability within clinic operations. However, this solution decreases the quantity of appts with providers and also requires reliable medical students and careful staff coordination. See Figure 2 for an illustration of this concept.
By clinic definition, 55% of the patients arrive late to their appointment. The design team experimented with transferring the appointments of late patients to alternate clinic resources in order to reduce the impact of late arrivals. (1) **Design Description**

As previously stated, in order for a patient to be ready to be seen by a provider at their appt time, patients are asked to arrive 20 minutes prior to their appt time. Applying this definition to last year’s electronic appt records, 55% of the patients arrived “late”. As shown by Figure 1, late patients can have a negative effect on the clinic’s schedule when provider appts are scheduled back-to-back. A buffer period could be incorporated in between appts in anticipation of late patients, but this decreases the total amount of appts as the time for a buffer has to be reallocated from existing appts. This is not ideal and therefore the design team has developed a solution approach in which a Nurse will see patients who are more than 15 minutes late to their appt. The Nurse will see the late patient for ~20 minutes and the provider will then be briefed by a Nurse and follow-up with the patient for ~10 minutes when possible. An estimated 1-2 patients per day will see the Nurse.

(2) **Analytical Investigations**

Through the analysis of 6 months of electronic appt records and over 50 observations of clinic process times, such as the total visit time, time with a provider, triage time, and transit time, the design team was able to accurately represent the current state of the clinic in an ARENA simulation model. A z-test and Chi-Square test for variance comparing the observed total time within the clinic with the simulated time revealed that there was no significant difference between the two means and variances, thereby verifying the accuracy of the ARENA model (Rep 5.3.2).

Analytical results demonstrated that utilizing a Nurse for late patients had minimal impact; however, this solution was immediately implementable and strongly supported by BMC staff.

(3) **Experimental Investigations**

This design was piloted in March 2013. Over seven days, five patients were late and seen by the Nurse. On average, the total time with the Nurse, provider, and in the clinic were 19, 13, and 54 minutes, respectively. Anecdotally, the providers enjoyed the program and stated that they could feel effects of not being rushed. The Nurses thoroughly appreciated the increase in direct patient care and did not believe that this caused a distraction that was detrimental to their daily work.
(4) Key Advantages of Recommended Concept

The recommended concept features a no-cost solution that alters the late patient procedure in a way that increases the clinic’s ability to attain an on-time schedule while still meeting clinic goals and policies. Overall delays, utilization rates of providers, and average total time in the clinic were all reduced – allowing for improvements in the overall quality of care while enabling the clinic to meet current and future demand. Furthermore, the roles within the clinic can become better matched to the level of expertise, including shifting the Nurses’ time from social work to nurse-specific roles, like examining patients.

Financial Issues

Financial resources are limited at this safety-net hospital; therefore, any proposed project solutions must have minimal cost to the medical center. As BMC serves low income and uninsured patients, solution development is financially constrained. It is imperative that solution paths have little to no costs associated with them. There are plans to increase clinic staffing in the future and the team will recommend an ideal staff profile. It is important to add staff members that will increase clinic productivity and efficiency, while maintaining billable resources and remaining within the budget allocated for staff member salaries.

Recommended Improvements

As the total patient count increases, it will become more important for a staff member’s position to be matched to their level of expertise. The design team has also recommended scheduling solutions that have optimized the overbook and new patient appt times. Analytical results demonstrated that, on average, utilizing a Nurse for late patients and optimizing the appt schedule improves the on-time schedule attainment percentage from 21.2% to 28.5%, which corresponds with a reduction in provider utilization by 8% and a decrease in average total visit time by 6 minutes. Over a full day, this equates to a savings of over 2 hours.

As the quantity of patients served by the clinic grows, the quantity of late arrivals will also increase, requiring more of the Nurses’ time. Through limited observation it has been determined that the Nurses spend an estimated 45% of their time on prescription and social work activities. These activities could be completed by someone with less medical training, freeing the Nurses time for appropriate nursing activities, such as seeing late patients.