Improving and Engineering Appointment Access in Rheumatology at Boston Medical Center

Design Team
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Design Advisor Sponsor
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Abstract
This Capstone Design Project consists of improving appointment access in the Rheumatology department at Boston Medical Center (BMC). While there is currently no access problem in the department the team was asked to find methods to improve appointment access if it does. After reviewing research the team determined to achieve this goal by increasing the capacity of the system which will allow the department to schedule more appointments in a day. This will be done through two methods: process improvement and additional resources. To improve the process the team has looked at altering the schedule to better reflect the patients’ desires. This has been done by collecting surveys of patients’ preferences. Attempts at improving the efficiency of the department have been done by identifying the bottleneck areas of the process however this efficiency is limited by the variation in the appointment length. Adding resources to the department will come in the form of additional operating hours or additional providers. To determine when these additions are necessary an Excel tool has been developed using Visual Basic (VB) to model the appointment access over time based on the capacity of the department and the appointment demand.

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The Need for Project

In the Rheumatology Department at Boston Medical Center there is currently no specific method used to alleviate spikes in the appointment access which occur throughout the year, primarily when the department is not operating at full capacity. If access goes beyond a certain threshold the clinic sees an incurred cost both financially and in the form patient dissatisfaction. At Boston Medical Center this threshold we were given is 14 days. In order to reduce the access level the department needs to increase the capacity of the clinic; this is normally accomplished by adding overtime. As it currently stands there is no method for determining when or how much overtime should be added, it is simply added on an ad hoc basis.

The Design Project Objectives and Requirements

Design Objectives

The objective of our project is to provide the department with multiple methods of increasing the capacity so it can handle a higher volume of patients which will in turn reduce the appointment access to an acceptable level below a given threshold.

Design Requirements

While researching appointment access improvement methods we wanted to ensure that we met the Health Care Triple Aim: improving access, increasing quality, and reducing cost. Our methods were to be determined without compromising any of the three in the process.

With those goals in mind we began studying the process in the department to identify which steps were the bottlenecks. The lead time in the system will be entirely dependent on these bottleneck steps. Once these steps were identified we could provide recommended solutions, however these solutions could not compromise the integrity of any of the three criteria listed above.

In the design of the Excel tool our primary goal was to provide accurate results of the appointment access over time. With that goal in mind we also wanted to create an intuitive and aesthetically pleasing tool which would allow for an individual to use it with minimal training.
**Design Concepts Considered**

Initially our solution path was strictly using process improvement methods. We decided to add a method to determine clinic capacity for a possible solution. Initially we considered strictly looking at process improvement methods, specifically finding and locating bottlenecks and other areas of waste in the process as well as allocating work to other areas of the clinic to allow for the doctor to see more patients. These methods included the possibility of group treatment for patients with similar ailments and giving the nurses in the department some of the tasks the doctors currently do. We researched altering scheduling methods, reducing the no-show rate and operating at the hours preferred by the patients if the clinic did not already do so. As we continued to work on our project we came to the conclusion that increasing appointment access through only process improvement methods would not be an effective solution on its own. After discussing it with our advisor we decided to create the Excel tool in addition to looking at process improvement methods.

**Recommended Design Concept**

Our solution consists of identifying the bottleneck in the process, recommending a different scheduling system in line with the patients’ preferences, and designing a tool to model appointment access overtime. After thoroughly studying the process in the department it was determined that the lead time is primarily dependent on the appointment length, or the amount of time the doctor spends with the patient. As it currently stands, 2 different appointment block lengths are used in the scheduling process: 20 minutes for new patients and 40 minutes for existing patients. These values do not accurately reflect the actual time the doctor spends with the patient however. If the lead time is to be significantly reduced the scheduled appointment length and the actual appointment length need to be congruent with one another.

<table>
<thead>
<tr>
<th></th>
<th>New</th>
<th>Existing</th>
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<tbody>
<tr>
<td>Avg (mins)</td>
<td>33</td>
<td>37</td>
</tr>
<tr>
<td>StDev (mins)</td>
<td>12</td>
<td>9</td>
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After performing surveys with the patients it was determined that the hours the clinic operates and the preference of the patients do not match. As it currently stands the clinic does not have any available appointments on Wednesday morning as it is set aside to allow for
administrative work. This is a time the patients would prefer to have available appointments according to the results of our survey. Our recommendation is to open the department for appointments on Wednesday morning and move the administrative period to Friday afternoon, a period patients didn’t prefer to have an appointment during.

Finally we designed a tool with Visual Basic to be used in Excel which models the appointment access over time as it relates to the capacity of the system. This can be used to determine whether or not the current capacity will be able to adequately meet the appointment demand. The capacity and the appointment demand are both able to be assigned manually by the user. The appointment access level is then calculated automatically as the simulation runs to provide the user with the resulting appointment access level over time. A threshold can be assigned by the user to allow for overtime to be added to the regular capacity to help reduce the access level if it exceeds that threshold. Other values which the user can define include the number of patients each provider can see per hour, the amount of overtime to be added if access exceeds the threshold and the cost incurred by the department due to access exceeding the threshold.

<table>
<thead>
<tr>
<th>Input</th>
<th>Session</th>
<th>Available Providers</th>
<th>Hours</th>
<th>Request Rate</th>
</tr>
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<tbody>
<tr>
<td>Monday</td>
<td>AM</td>
<td>4</td>
<td>4</td>
<td>35.000</td>
</tr>
<tr>
<td></td>
<td>PM</td>
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<td>Tuesday</td>
<td>AM</td>
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<td>Wednesday</td>
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<td>4</td>
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<td>Thursday</td>
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<td>Friday</td>
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<td>PM</td>
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</tbody>
</table>

Patients/Hour: 1
Seed: 1
Simulation Length (days): 50000
Available Overtime Providers: 2
Available Overtime Hours: 2
Initial Access Level (Days): 0
Cost of Access Level ($C_o$): 10
Cost of Adding Resources ($C_A$): 5
Cost of Each Resource ($C_e$): 2
Access Threshold (Days): 5

*Simulation Tool – Input*
The primary advantage of the first two solutions is to bring awareness to the problems the department currently has in the way its scheduling operates. The scheduled appointment length and the actual appointment length do not match resulting in an inefficient, congested department. Additionally the department does not always operate at hours which are preferred by their patients. Changing the scheduling to better reflect the patients’ needs will result in a more efficient process.

By using the simulation tool the department will have a better understanding of the relationship between their capacity and appointment demand, and the resulting appointment access level. It will also provide a more accurate method of adding resources in the department to help reduce the access level when it exceeds their threshold.

Financial Issues

The researching and development of our design solution did not require any costs. The implementation of the solution will require cost on the part of the user. While researching and designing our solution we did not encounter any instances of cost. The implementation and use of our solutions will however cost Boston Medical Center if they were to use the proposed solution. These costs include altering the schedule to fit the needs of the patient and adding resources in the form of overtime. This cost should however be offset in the form of a lower appointment access level.
Recommended Improvements

While we believe our methods at improving the process of the clinic were helpful there is always room for improvement. The process would require more studying to identify other areas of waste which were missed and could be eliminated.

The design tool could be made more sophisticated, which in turn could provide with different or possibly more accurate results. This level of sophistication would be based on the needs of the user. As it stands our tool accurately models the appointment access over time. A more detailed scheduling system could be put in place however this may come at the price of usability as it would require an even greater deal of information on the part of the user. A more accurate cost model could be implemented as well which takes into account the cost of every step in the process. Our model currently assigns a cost value only to the resources used in the form of doctors and to the access level. This more sophisticated tool could provide more value to the user but it is also possible that it may result in a decrease in usability as it becomes more complicated to use.

More process improvement methods could possibly be identified. The simulation tool could be made more sophisticated.