University of Michigan

Industrial and Operations Engineering 481

Special Projects in Hospital System

CVC Clinic Lead Time Project

“An Analysis of Patient Wait Times”

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EXECUTIVE SUMMARY

The Cardiovascular Center (CVC) Clinic is located on the 3rd floor of CVC on the University of Michigan Health Systems (UMHS) Campus. The clinic provides over 700 outpatient consultations a week with specialties in general cardiology, cardiac surgery and vascular surgery. The clinic also houses ancillary testing units including interventional radiology and phlebotomy (blood) lab.

Background

The Clinical Operations Administrative Manager expressed CVC in-clinic wait times as a problem because patients often get frustrated when waiting long. Frustrated patients cause stress for clinic staff. Clinic delays sometimes lead to service recovery (parking and meal vouchers and mile reimbursements for patients) and overtime charges for the clinic.

The IOE 481 project team was asked to study the causes of excessive patient wait times in CVC Clinic and recommend solutions for reducing these wait times. The manager was specifically concerned with the Heart Failure (HF) and Electrophysiology (EP) clinics (both are sub-clinics of general cardiology) because these two clinics are scheduled to receive “destination program” status in 2011. A destination program is designed to accommodate patients traveling from great distances and making appropriate accommodations for the patients while receiving care at UMHS.

Project Goals

The project goals were to find clinic visit bottlenecks and evaluate and recommend improvement strategies for the effectiveness of the clinic’s patient appointment scheduling method. A secondary goal of the project was to develop recommendations for a visual metric system for management to monitor patient wait times in real time.

Methods

To achieve the project goals, the team first mapped the clinic flow processes for the HF and EP clinics based on informal interviews with medical assistants. The process flows were then used to create a patient time study form, which the team used to collect data. The team validated the data collection process and collected 180 patient time study forms between 10/11/10 – 11/05/10. The data was analyzed using Microsoft Excel spreadsheets and Minitab statistical...
software. The team also created a physician survey (on a web based platform) to gain insight into physician’s perceived causes of clinic delays. Responses were received from 10 out of 15 physicians between 11/17/10 – 11/22/10.

Findings and Conclusions

The team split the findings into two sections: Patient wait time analysis and Scheduling Grid Effectiveness.

Patient Wait Time Analysis

The team identified large variability in providers’ treatment time in both clinics studied. This variability was linked to long waiting times (and large variability in these wait times) for patients before being consulted by the physicians. Long patient wait room wait times may indicate an ineffective scheduling method as patients are scheduled to arrive for appointments before the physicians are available (completed the consultations of preceding patients).

Scheduling Grid Effectiveness

The scheduling grids were ineffective (did not schedule enough time for the patient’s visit to complete) for 98% of all patient appointments studied. The patient visit duration exceeded the scheduled grid time by 60 – 80 minutes on average for all appointments. The grids were equally ineffective for the HF new patient and return visit populations with 100% of the visits exceeding the scheduled grid time. For the EP new patient population grids were ineffective for 94% of new patient visits and for 99% of return visits.

The team identified possible root causes of grid inefficiencies:

- Interpretation of the scheduling grids is non-standard among physicians
- Setup of the grids is not based on science
- Appointment capacity for physicians is limited which leads to overbooked scheduled appointments (2 appointments starting at the same time with the same physician)
- Availability of auxiliary providers (any provider other than physician) is non-standard
Recommendations

The summary of the team’s recommendations for reducing patient wait times and improving the clinic’s scheduling method is:

- Standardize clinic processes to reduce variability
- Staff the clinic proportionally to the number of appointments scheduled
- Improve the clinic appointment scheduling to reflect the time required to complete a patient’s visit
- Improve information flow to inform all providers of how long patients have been waiting to be consulted (use of a visual metric system)

INTRODUCTION

The Cardiovascular Center (CVC) Clinic is located on the 3rd floor of CVC on the University of Michigan Health Systems (UMHS) Campus. The clinic provides over 700 outpatient consultations a week with specialties in general cardiology, cardiac surgery and vascular surgery. The clinic also houses ancillary testing units including interventional radiology and phlebotomy (blood) lab. Each testing unit functions under different management and operates by separate schedules, which can lead to spikes in patient wait times if unscheduled patients are sent to these testing units by physicians.

Recent patient satisfaction reports, cardiology patient focus groups and Aortic Destination Program consultants identified in-clinic wait times as a problem. Service delays in the CVC Clinic are perceived to be caused by inefficient physician grid alignment (physicians’ schedule for the clinic), unsynchronized clinic testing schedules, and unpredictable provider (any clinician such as a physician, fellow, nurse or medical assistant) and patient arrival times. Service delays sometimes lead to operating expenses (parking and meal vouchers and mile reimbursements for patients), decrease in patient and staff satisfaction and loss in market share.

PROJECT BACKGROUND

The Clinical Operations Administrative Manager expressed CVC in-clinic wait times as a problem because patients often get frustrated when waiting long. Frustrated patients cause stress for clinic staff. Clinic delays sometimes lead to service recovery (parking and meal vouchers and mile reimbursements for patients) and overtime charges for the clinic.
The IOE 481 project team was asked to study the causes of excessive patient wait times in CVC Clinic and recommend solutions for reducing these wait times. The manager was specifically concerned with the Heart Failure (HF) and Electrophysiology (EP) clinics (both are sub-clinics of general cardiology) because these two clinics are schedules to receive “destination program” status in 2011. A destination program is designed to accommodate patients traveling from great distances and making appropriate accommodations for the patients while receiving care at UMHS.

PROJECT GOALS AND OBJECTIVES

The project goals were to find clinic visit bottlenecks, evaluate and recommend improvement strategies for the effectiveness of the clinic’s patient appointment scheduling method. The team had fulfilled this goal by:

- Collecting clinic visit process data and analyzing it for trends
- Identifying clinic visit process bottlenecks and their root causes
- Developing and recommending an improved scheduling method for scheduling patients to reduce patient wait times

A secondary goal of the project was to develop recommendations for a visual metric system for management to monitor patient wait times in real time.

PROJECT SCOPE

This project focuses on the Heart Failure (HF) and Electrophysiology (EP) clinics within the general cardiology clinic in the CVC. The appointments of all physicians within these two clinics, with the exception of one physician who declined to participate, are in the project’s scope. For the appointments in scope, the team focused on all patient-provider interactions during the patients’ visit from check-in to check-out. One patient-provider interaction is defined as one instance of a patient being seen by a clinician. A single patient visit may include multiple such interactions.

Additional unscheduled testing that requires the patient to leave the clinic and return during the same clinic visit is not included in the study. Such testing may include right heart catheterizations and echocardiograms.
METHODS

First, the team mapped the clinic flow processes for the HF and EP clinics based on informal interviews with medical assistants; these flows are displayed in Appendices A and B. The process flows were then used to create a patient time study form, which the team used to collect data; this form is pictured in Appendices C and D. The time study form was designed such that patients will provide the team data about their clinic visit. This method of delegating the data collection process to patients enabled the team to collect a large amount of data (180 patient responses out of which 150 were usable; some forms were incomplete and were discarded) with minimal impact on clinic staff activities. The team collected data between 10/11/10 – 11/05/10. Figure 1 outlines the team’s data collection process, followed by a description of each step.

Figure 1: Patient Time Study Process Flow

The steps in the team’s data collection process were:

- Patient checks in at the reception desk
- Clerk hands the patient a time study form and instructs patient to read the instructions
- Patient waits until an exam room is available
- Medical assistant (MA) takes the patient into the vitals area; vitals refers to the MA taking the patient’s blood pressure and heart rate, height and weight, and then updates the patient’s medication list
- Patient starts filling out the time study form
MA places a patient identifying label on the patient’s time study form and places the patient in an exam room

- Patient completes the form while in the exam room with no additional input from clinic staff
- Patient leaves the exam room at the completion of the examination and continues to check out
- Check-out clerk collects the form upon the completion of the patient’s visit

The team then validated the data collection process (between 10/11/10 – 10/15/10) to determine the accuracy of the patient responses on the time study forms. Validation is a necessary step to establish the integrity of the data collected. To validate the data collection process, team members sat in view of the patient exam rooms performed the following tasks:

- Recorded the times at which patients are placed in exam rooms on copies of the same time study form patients received at check-in
- Noted the type of provide that entered the patient’s exam room and the time when this occurred; noted the time when the provider and patient left the room
- Analyzed the results to determine if the patient responses are statistically similar to the team’s observations

The team observed 12 patients (sample size n = 12). The results of the validation are summarized in Figure 2.
Figure 2: Boxplots show similarity in patient responses and team’s observations (validation)

If the validation box was overlaid on top of the patient response box and the means (centers) of both boxes were within the union region (area covered by both boxes), the two response types are considered similar by the boxplot test. From Figure 2, the team concluded that patient responses were similar in both mean value (center of the box) and variation (height of the box). This conclusion established the validity of the data collection process.

The team created an Excel spreadsheet to record the raw data from the patient time study forms and automatically extract summary data for analysis. Summary data includes:

- the average consult and wait times for each provider,
- the number of providers that consulted each patient,
- the total duration of the patient’s visit.

The team also created a physician survey to gain insight into physician’s perceived causes of clinic delays. The survey was created in Qualtrics, a web based survey platform, and distributed to all physicians in the HF and EP clinics (15 physicians in total) via email. A total of 10 responses were collected between 11/17/10 – 11/22/10. The results of the survey are discussed in the Findings section.
The clinic manager provided the team with a spreadsheet containing the scheduling grid (physician’s schedule for the clinic) preferences for all physicians in the two clinics under study. The grid preference spreadsheet was used to analyze the effectiveness of the scheduling grids relative to the patient response data collected by the team. The scheduling grids are described and analyzed in the Findings section.

FINDINGS and RECOMMENDATIONS

The findings and recommendations are divided into three sections: clinic visit process wait time analysis, scheduling grid analysis, and visual metric system design. Recommendations are detailed at the end of each section.

Insights from the Physician Survey

To develop recommendations that address the primary concerns of clinic members, the team sought input from physicians in addition to the patient filled time study forms. The team designed a physician survey (in online format) in collaboration with the clinic manager. The surveys were emailed out to all the Physicians by the clinic manager and responses were collected between 11/17/10 – 11/22/10. Out of the 15 physicians emailed, 10 completed the survey.

The survey consisted of 10 questions. Some of interesting insights included:

Survey Question 1

1. The CVC Clinic is working with a team from the Engineering School to find ways to improve clinic flow. As part of this initiative we seek your feedback to address the primary concerns of clinic members. This short survey will take about 5 minutes to complete. Thank you for your time and feedback! How much time is needed on average - per patient – to go over the patient’s medical situation outside the exam room?

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>Min Value</th>
<th>Max Value</th>
<th>Average Value</th>
<th>Standard Deviation</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>In minutes:</td>
<td>5</td>
<td>10</td>
<td>7.86</td>
<td>2.67</td>
<td>7</td>
</tr>
</tbody>
</table>
From the responses to Question 1, physicians spend almost 8 minutes per patient going over the patient’s medical situation outside the exam room. Some patients also seem to need more preparation time then others as suggested by the standard deviation of responses. This preparation time is not currently included in the current appointment scheduling method.

Survey Question 3

3. How are you notified of how long patients have been waiting to be seen in clinic?

<table>
<thead>
<tr>
<th>Text Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>I’m not.</td>
</tr>
<tr>
<td>No. I try to stay on time. Some need to be reminded that they are holding clinic. That is not me.</td>
</tr>
<tr>
<td>I am never notified about how long patients have been waiting.</td>
</tr>
<tr>
<td>inconsistently, but I almost never run late - the MA has alerted me in person in past about impatient or agitated pts</td>
</tr>
<tr>
<td>I have not been notified.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Responses</td>
<td>5</td>
</tr>
</tbody>
</table>

The responses to this survey question show that none of the physicians are notified or aware of how long the patient has been waiting to be consulted. This conclusion suggests there is inadequate communication between the clinic entities (staff and providers). A visual metric system may be useful in informing physicians (and all other providers) of how long patients have been waiting to be consulted.
Survey Question 10

10. Based on your observations, what are the most common inefficiencies that lead to clinic delays?

<table>
<thead>
<tr>
<th>Text Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>EKGs being done during clinic time (should be done before appt time)</td>
</tr>
<tr>
<td>Overbooking is a big problem. I generally overbook 2 slots per session, planning on about 2 cancellations/no shows. When all arrive, and none cancel/no show, then the day sees delays. When patients arrive late, I generally see them anyway, and this makes the subsequent patients late.</td>
</tr>
<tr>
<td>staff processing pts to get from waiting room to exam room and getting preliminary data (vitals, ECG)</td>
</tr>
<tr>
<td>Multiple unpredictable events as listed in question on reasons for patients waiting.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Responses</td>
<td>4</td>
</tr>
</tbody>
</table>

This is was the last question of the survey. Physicians shared their ideas for improving clinic flow. The physician’s recommendations were considered in the team’s recommendations for reducing patient wait times and improving the clinic’s scheduling method, as described in the next sections.

Clinic Visit Process Wait Time Analysis

The team divided the Wait Time Analysis section into two parts: Analysis of the Heart Failure (HF) clinic and Electrophysiology (EP) clinic. Each clinic functions differently as its own process and patients require different treatment types between the two clinics; therefore the team will analyze each clinic separately.

Figure 3 shows the proportions of each patient visit type that the team has collected data on.
Figure 3: Proportion of each visit type out of all appointments in the project’s scope

n=149, patient visit data collected by project team 10/11-11/5, CVC clinic

Observations:
- HF:RV make up for almost 50% of all clinic visits
- HF: NP only account for around 6%
- EP clinic is more evenly distributed with NP (20%) and RV (25%) then HF clinic with NP (5.52%) and RV (49.66%)

**Heart Failure Clinic**

The Heart Failure (HF) clinic provides consultations to both New Patient (NP) and Return Visit (RV) patient types. The consultations for each patient type are analyzed separately.

**New Patients**

Figure 4 shows the proportions of value added time (consult time by any provider) versus wait time (patient is unattended and waiting for any provider) of a HF-NP visit. The dark shaded area represents value added time and light shaded area represents wait time for the patient.
On average, patients spend almost an hour waiting for service. These high level observations show there is room for improvement.

The value stream map (VSM) in Figure 5 further decomposes the average patient’s visit into wait times and consult times for each individual process (EKG, Provider1, Provider2, and Check-in/out) as well the standard deviation of each process. In the VSMs in this section, Provider1 always refers to the physician. For new patient appointments, Provider 2 refers to nurse practitioner (NP) or registered nurse (RN). For return visit appointments, Provider 2 refers to NP, RN, Fellow or Resident.
The light shaded blocks represent parts of the patient’s visit where the patient is waiting. Dark shaded areas represent the patient being consulted by a provider. The VSM also displays the average durations of each stage in the patient’s visit along with the standard deviations. The horizontal width of each block is proportional to the length of the process step relative to the entire visit duration. The team considered areas of concern (areas with for improvement) the consult blocks with high variability (standard deviation) and the wait blocks with the largest mean duration.

From Figure 5, Provider 1 has large variability in consult time; the mean consult time is 34 minutes with standard deviation of 21 minutes. This variability in consult times leads to and amplifies the variability in wait times for patients. This conclusion is supported by the large variability seen in wait room wait times; mean wait room wait time is 19 minutes with standard deviation of 28 minutes.

Provider 2 has smaller variability in wait times relative to the mean consult time (mean of 45 minutes with standard deviation of 21 minutes) than Provider 1. This lower variability should lead to lower variability in the wait times for Provider 2. From Figure 5, wait times for Provider 2 have a mean of 29 minutes, with a standard deviation of 9 minutes. The low standard deviation and long mean wait time may be due to unavailability of the second provider. Provider 2 for HF-
NP appointments may be an RN or NP, which are not always in clinic. The long wait times for this provider support the conclusions that this provider is not always available in clinic. The wait times for the second provider are the longest wait period for new patients in the HF clinic.

*Return Visits*

Figure 6 shows the proportions of value added time (consult time by any provider) versus wait time (patient is unattended and waiting for any provider) of a HF-RV visit. The dark shaded area represents value added time and light shaded area represents wait time for the patient.

Figure 6: HF-RV Value Added Time vs. Wait Time

![Pie chart showing value added time and wait time](image)

\[\text{Value Added Time: 46\%} \\
\text{64 minutes}\]

\[\text{Wait Time: 54\%} \\
\text{74 minutes}\]

n=76, patient visit data collected by project team 10/11-11/5, CVC clinic

On average, patients spend more than an hour waiting for a provider. These high level observations show room for improvement.

The VSM in Figure 7 describes the visit process for heart failure return visit appointments. The format of Figure 7 is consistent with the VSM in Figure 5.
Using the same criterion (high mean wait times and high consult time variability) areas of concern in the HF-RV process are patient wait room wait time, wait time for Provider 1, and the variability in Provider 1’s consult time.

From Figure 7, the mean patient wait room wait time is 26 minutes, with very standard deviation of 24 minutes. Wait room wait times are longer for return visits than for new patients on average. Provider 1 has large variability in consult time; the mean consult time is 25 minutes with standard deviation of 16 minutes. This variability in consult times leads to and amplifies the variability in wait times for patients. This conclusion is supported by the large variability seen in wait room and Provider 1 wait times.

Provider1 Wait Times have a mean of 21 minutes with a standard deviation of 14 minutes. Unlike NP’s, RV’s have a longer wait for the first provider. It is the longest wait period for RV in HF. The high variability in treatment times amplifies variability in wait times for the first provider. From the results of the physician survey, some of the patients may undergo additional testing.
since last clinic visit. The physicians have to gather and analyze these tests before consulting the patients which increases patients wait time.

Figure 8 shows the high variability in wait room wait times.

**Figure 8: Variability for Wait Room Wait Times for HF-RV visits**

- From Figure 8, the longest wait times and highest variability is right before noon (lunch period).
- This condition may be caused by variability in Provider 1 consult times around noon.

**n=46, patient visit data collected by project team 10/11-11/5, CVC clinic**

Figure 9 shows the high variability in Provider 1 consult time.
Figure 9: Variability for Provider1 Consult Times for HF-RV visits

n=46, patient visit data collected by project team 10/11-11/5, CVC clinic

Figure 9 shows the high variability in Provider1 consult times, especially right after noon. The longer Provider1 consult times correlate with longer wait room wait times for patients, as shown in Figure 8. The combination of longer wait room wait times before noon, and longer consult times right after noon slows down the clinic process.

This proves that this variability propagates and is amplified throughout the clinic visit process.

Electrophysiology Clinic

The Electrophysiology (EP) clinic provides consultations to both New Patient (NP) and Return Visit (RV) patient types. The consultations for each patient type are analyzed separately.

New Patients

Figure 10 shows the proportions of value added time (consult time by any provider) versus wait time (patient is unattended and waiting for any provider) of an EP New Patient visit. The dark
shaded area represents value added time and light shaded area represents wait time for the patient.

Figure 10: EP-NP Value Added Time vs. Wait Time

Value Added Time: 37%
26 minutes

Wait Time: 63%
29 minutes

n=29, patient visit data collected by project team 10/11-11/5, CVC clinic

On average, patients spend more time waiting for a provider then being consulted by one. These high level observations show room for improvement.

The value stream map in Figure 11 further decomposes the average patient’s visit into wait times and consult times for each individual process (Provider1, Provider2, and Check-in/out) as well the standard deviation of each process. The formatting is consistent with the VSM’s in the Heart Failure section. The light shaded boxes patients waiting for a provider. The dark shaded boxes represent a provider’s consult time.
Using the same criterion (high mean wait times and high consult time variability) areas of concern in the EP-New Patient visit process are patient wait room wait time and wait time for Provider 1 due to their large mean and variability, as described in Figure 11. The variability in Provider 1’s consult time is also of concern and may be the cause of the large variability in the previously mentioned wait times. The variability in Physician 1’s consult times is shown in Figure 12.
The variability in Provider 1’s consult time may be the source of the large variation in patient wait room wait time and wait time for Provider 1 as the variability propagates and is amplified throughout the visit process.

**Return Visit**

Figure 13 shows the proportions of value added time versus wait time of an EP Return Visit. The dark shaded area represents value added time and light shaded area represents wait time for the patient.
n=46, patient visit data collected by project team 10/11-11/5, CVC clinic

On average, patients spend 18 minutes waiting for a provider. These high level observations show room for improvement.

The value stream map in Figure 14 further decomposes the average patient’s visit into wait times and consult times for each individual process (Provider1, Provider2, and Check-in/out) as well the standard deviation of each process. The formatting is consistent with the VSM’s in the Heart Failure section. The light shaded boxes patients waiting for a provider. The dark shaded boxes represent a provider’s consult time.
Using the same criterion (high mean wait times and high consult time variability) areas of concern in the EP-New Patient visit process are again patient wait room wait time and wait time for Provider 1 due to their large mean and variability, as described in Figure 14. The wait time for check-out is also of concern; the large mean and variation are unusual for this step of the visit process. A possible explanation for the large waits for check-out may be that the clinic was short staffed during the team’s data collection period with two clerks being on vacation leave. The variability in Provider 1’s consult time is also of concern and may be the cause of the large variability in the previously mentioned wait times. The variability in Physician 1’s consult times is shown in Figure 15.
Figure 15: Variability for Provider1 Consult Times for EP-RV visits

Variability in physician treatment time

n=19, patient visit data collected by project team 10/11-11/5, CVC clinic

The variability in Provider 1’s consult time may be the source of the large variation in patient wait room wait time and wait time for Provider 1 as the variability propagates and is amplified throughout the visit process.

Conclusions

There is variability in provider consult times and availability of the second provider, both of which lead to unpredictable patient wait times. Ineffective communication between providers may be a cause of the variability. Another cause may be that the complexity of each patient’s visit varies from patient to patient.

Recommendations

The clinic management should strive to reduce variability in the clinic visit processes. If this is not possible, the team recommends:

- Staff and providers should be available proportional to the number of appointments scheduled
- Physicians should have information about patient records in advance for return visit patients
- Scheduling grids should be revised to better account for the variability in the clinic visit processes (discussed in the Scheduling Grid Effectiveness section)
**Scheduling Grid Effectiveness**

Patient appointments for the CVC clinic are scheduled by CVC Call Center. The call center staff uses software called EWS to schedule appointments into each physician’s scheduling grid. The scheduling grid represents a list of time slots the physician has available to see patients in clinic. A grid contains the duration of New Patient and Return Visit appointments as well as the sequence in each type of appointment to be scheduled, both specified by the physician. The grid reflects the physician’s preference for every day the physician schedules clinic (physicians may schedule clinic multiple days a week). Once the grid for a specific day is populated with patient appointments, the physician uses the grid as the schedule for their clinic day. An example grid may look like this:

**Table 1: Scheduling Grid Example**

<table>
<thead>
<tr>
<th>Start Time</th>
<th>MONDAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:20</td>
<td>OFF DUTY</td>
</tr>
<tr>
<td>8:30</td>
<td>New Patient</td>
</tr>
<tr>
<td>8:40</td>
<td></td>
</tr>
<tr>
<td>8:50</td>
<td></td>
</tr>
<tr>
<td>9:00</td>
<td></td>
</tr>
<tr>
<td>9:10</td>
<td></td>
</tr>
<tr>
<td>9:20</td>
<td></td>
</tr>
<tr>
<td>9:30</td>
<td>Return Visit</td>
</tr>
<tr>
<td>9:40</td>
<td></td>
</tr>
<tr>
<td>9:50</td>
<td></td>
</tr>
<tr>
<td>10:00</td>
<td>Return Visit</td>
</tr>
<tr>
<td>10:10</td>
<td></td>
</tr>
<tr>
<td>10:20</td>
<td></td>
</tr>
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<td>10:30</td>
<td>Return Visit</td>
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<td>10:50</td>
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<td></td>
</tr>
<tr>
<td>11:20</td>
<td></td>
</tr>
<tr>
<td>11:30</td>
<td>Return Visit</td>
</tr>
<tr>
<td>11:40</td>
<td></td>
</tr>
</tbody>
</table>
In the above case, the physician prefers that New Patient appointments be scheduled for 60 minutes, Return Visits for 30 minutes, only one New Patient appointment scheduled for Mondays at the start of the clinic, followed by Return Visits until the end of clinic at 12 pm. A physician may hold clinic in both the morning and the afternoon. The setup of the physician’s grid is at the sole discretion of the physician. The appointment start time displayed on the physician’s grid is the same as the appointment time on the patient’s itinerary.

In theory, an effective scheduling grid is one that accurately reflects the total time required to complete the patient’s visit for a particular scheduled appointment. If the scheduled duration of an appointment is shorter than the time required for the visit, the physician will run behind, increasing the wait times for subsequent patients. If the scheduled duration is longer than the time required to complete the visit, the physician might be idle if there are no patients ready to be consulted. This is undesirable since physicians are the clinic’s most expensive resource.

The team analyzed the grid effectiveness for each of the four main clinic populations under study: Heart Failure (HF) – New Patient, HF – Return Visits, Electrophysiology (EP) – New Patients, and EP – Return Visits. The physician survey revealed that all physicians interpret the grid time slot scheduled for an appointment as the estimate for the patient’s entire visit duration. Given this assumption, the project team measured the grid effectiveness by the percent of visits that were completed within the scheduled grid time.

Results

The team will first discuss the overall effectiveness of the grids for all appointments in scope, followed by the grid effectiveness for each of the four clinic populations. Chart 1 shows the actual visit durations relative to the scheduled grid time for all patient visits for which the team collected data. The data displayed represents the difference between the patients’ visit durations and the scheduled grid time slot. Data with negative values on the X-axis mean the grids allowed enough time for these visits to complete; these values are shaded dark. Data with positive values on the X-axis mean the visit durations exceeded the grid times. This format will be consistent for figures 16 through 21.
Figure 16: Scheduling Grid Effectiveness for all appointments in scope

![Scheduling Grid Effectiveness](image_url)

* Average visit duration = grid slot; 2% of visits are within the grid slot

n=65, patient visit data collected by project team 10/11-11/5, CVC clinic

From Chart 16, only 2% of all patient visits were completed within the scheduled grid time. This indicates the grids were ineffective for 98% of all appointments studied. Some visits were over 200 minutes longer than the grid time, while the average visit duration was between 60 and 80 minutes longer than the grid time. In other words, if an appointment was scheduled to be completed in 30 minutes for example, the duration of the patient’s visit would likely exceed this time by 60 to 80 minutes.

**Heart Failure – New Patient**

Chart 17 shows the actual visit durations relative to the scheduled grid time for Heart Failure – New Patient appointment. Chart 17 follows the same format as Chart 16.
n=4, patient visit data collected by project team 10/11-11/5, CVC clinic
From Chart 17, the scheduling grids were ineffective for all appointments studied in this population. The sample size n for this population is 4, which is too small for statistical significance. The team collected fewer data for New Patient than for Return Visit appointments, for both the HF and EP clinics, because physicians typically consult 90% return visit patients during one clinic. Further data collection should be pursued specifically for New Patient appointments to establish a statistically significant pattern in grid performance for this population.

*Heart Failure – Return Visit*

Chart 18 shows the actual visit durations relative to the scheduled grid time for Heart Failure – Return Visit appointments. Chart 18 follows the same format as Chart 16.
n=33, patient visit data collected by project team 10/11-11/5, CVC clinic

From Chart 18, the scheduling grids were ineffective for all appointments studied in this population. Some visits were over 160 minutes longer than the grid time slot, while the average visit duration was between 60 and 80 minutes longer than the scheduled grid slot.

Electrophysiology – New Patient

Chart 1.3 shows the actual visit durations relative to the scheduled grid time for Electrophysiology – New Patient appointments. Chart 19 follows the same format as Chart 16. Data with negative values on the X-axis mean the grids allowed enough time for these visits to complete; these values are shaded dark. Data with positive values on the X-axis mean the visit durations exceeded the grid times.
n=14, patient visit data collected by project team 10/11-11/5, CVC clinic

From Chart 19, the scheduling grids were effective for 6% of the appointments studied in this population. Inversely, the grids were ineffective for 94% of the appointments. The sample size n collected for this population was equal to 14, which is not enough for statistical significance. As stated for the Heart Failure – New Patient population, new patients appointments represent only approximately 10% of all Electrophysiology appointments. Further data collection should be pursued specifically for new patient appointments to establish a statistically significant pattern in grid effectiveness for this population.

* Visit duration = grid slot; 6% of visits are within the grid slot

Electrophysiology – Return Visit

Chart 20 shows the actual visit durations relative to the scheduled grid time for Electrophysiology – New Patient appointments. Chart 20 follows the same format as Chart 16.
Chart 20: Scheduling Grid Effectiveness for EP-RV visits

From Chart 20, the scheduling grids were effective for 1% of the appointments studied in this population. Inversely, the grids were ineffective for 99% of the appointments. Some visits exceeded the grid time slot by 160, while the average visit duration was between 40 and 60 minutes longer than the scheduled grid slot.

**Root Cause Analysis**

The team identified possible root causes responsible for the gross ineffectiveness of the scheduling grids. The interpretation of the scheduling grids, setup of the grids, limited appointment capacity and non-standard availability of auxiliary providers (any provider that is not a physician) are discussed in detail in this section. Need another sentence?

*Interpretation of the scheduling grid is no-standard among physicians*

The physician survey revealed that the interpretation of the scheduled appointment start time is not standard among physicians. Image 1 displays this finding.
Responses to the physician survey show inconsistency in grid interpretation among physicians

6. The appointment time on the patient's itinerary is the

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>Bar</th>
<th>Response</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>time patients should arrive for their appointment</td>
<td></td>
<td>3</td>
<td>50%</td>
</tr>
<tr>
<td>2</td>
<td>time patients should be seen by the physician</td>
<td></td>
<td>3</td>
<td>50%</td>
</tr>
<tr>
<td>3</td>
<td>other:</td>
<td></td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

From Image 1, half of the physicians that responded to the survey believe the appointment time is the time patients should arrive for their appointment, while the other half believes it is the time the patient should be seen by the physician. The latter interpretation leads the grid to fail, starting with the first patient of the clinic, since patients have the same appointment start time on their itinerary as the physicians do on their grid. Vitals must be recorded for every patient at the start of the patient’s visit; therefore, even in the ideal condition that the patient is on time and vitals process begins at exactly the scheduled appointment start time, the patient will be late for their physician consult. This condition is exacerbated if the patient has to be consulted by yet another provider, such as a nurse or resident, before being consulted by the physician.

**Setup of the scheduling grid is not based on science**

In theory, an effective scheduling grid is one that accurately reflects the total time required to complete the patient’s visit for a scheduled appointment. If the scheduled duration of an appointment is shorter than the time required for the visit, the physician will run behind, increasing the wait times subsequent patients experience. If the scheduled duration is longer than the time required to complete the visit, the physician might be idle if there are no patients ready to be consulted. This is undesirable since physicians are the clinic’s most expensive resource.
To account for the actual treatment time of the physician and each auxiliary provider that will consult the patient within the patient’s visit, a time study should be conducted first to identify the natural consult behavior of each provider. The consult times should be studied for each type of patient visit (i.e. New Patient, Return Visit) as consult times may not be the same for both types. Once the average treatment times are found, these times should be considered when assigning the grid slot durations for patients’ appointments. The team’s data collection was a step in this direction; however, the sample sizes collected for individual physicians are too small for statistical significance.

The setup of the physician’s grid is currently at the sole discretion of the physician. While the physician may have an accurate estimate regarding their own consult times, it is conceivable that the physician may not have a good estimate for the treatment times of the auxiliary providers. If the physician does not accurately estimate the consult times of the auxiliary providers, or does not account for all auxiliary providers that consult the patient before the physician, the grid slots will not allow appropriate amounts of time needed to complete a patient’s visit.

Chart 21 tests the claim that the physician may not accurately estimate the consult times of the auxiliary providers, or may not account for all auxiliary providers that consult the patient before the physician. The data displayed represents the difference between all physicians’ consult times and the scheduled grid time slot for all patient visits in scope. Chart 21 is formatted consistent with Chart 16. Data with negative values on the X-axis mean the grids allowed enough time for the physicians to consult the patients; these values are shaded dark. Data with positive values on the X-axis mean the physicians’ consult times exceeded the grid times.
Chart 21: Scheduling Grid Effectiveness for all appointments (relative to physician consult time)

From Chart 21, the grids allowed enough time for the physicians to consult the patient for 78% of patient visits. This indicates that the grid times are much better matched to the physician’s consult time compared to the patient’s entire visit duration, as displayed in Chart 1. This conclusion supports the claim that the physician may not accurately estimate the consult times of the auxiliary providers, or does not account for all auxiliary providers that consult the patient before the physician.

**Appointment capacity for physicians is limited**

Patient appointments for the CVC clinic are scheduled by the CVC Call Center. The call center staff uses software called EWS to schedule appointments into each physician’s scheduling grid. According to the CVC Call Center, the largest constraint when scheduling appointments for patients to see a physician is that the available appointment capacity is often less than the demand. If a patient requests an appointment but there is no available slot for the appointment in the physician’s grid, the call center asks the physician if the new appointment should be overbooked with another existing appointment. Overbooked appointments mean that the physician has two appointments that have the same start time. The physician decides if and where the new appointment should be scheduled within the grid.
Overbooking, if not done strategically, can increase patient wait times for all subsequent appointments following the overbooked appointment. Strategic overbooking, however, can be used to maintain a predictable number of patients in queue for the physician and may reduce patients’ wait times when used in conjunction with strategic open slots in the grid (conclusions are drawn from the results of a simulation study, which aimed to find the optimal grid setup of a vascular surgeon in the CVC Clinic, performed by Andrei Duma in October 2010). The optimal times to overbook appointments within a grid can be found through simulation, as to minimize the increase in patient wait times while maintaining the desired number in patients in queue (waiting to be consulted by the physician). It may be desirable to maintain a constant number of patients in queue to reduce the likelihood that the physician will be idle if a patient is late or misses the appointment.

Availability of auxiliary providers is non-standard

A standardized clinic visit process means that a standard list of auxiliary providers consult the patient, in addition to the physician, during every patient visit. For example, in a standardized process where all new patients are consulted by an RN (registered nurse) before being consulted by the physician, the RN would consult 100% of new patients. A standardized process enables the creation of a robust appointment scheduling grid by considering the consult times of all providers that will consult the patient. Table 2 summarizes the percent of visits in which a second provider consulted patients, in addition to the physician, for the patient visits in the project’s scope.

Table 2: Percent of visits in which a second provider consulted patients in addition to the physician, by clinic and visit type

<table>
<thead>
<tr>
<th>Clinic</th>
<th>New Patient</th>
<th>Return Visit</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Heart Failure</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Patient</td>
<td>62%</td>
<td>38%</td>
<td>8</td>
</tr>
<tr>
<td>Return Visit</td>
<td>84%</td>
<td>16%</td>
<td>79</td>
</tr>
<tr>
<td><strong>Electrophysiology</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Patient</td>
<td>90%</td>
<td>10%</td>
<td>29</td>
</tr>
<tr>
<td>Return Visit</td>
<td>77%</td>
<td>23%</td>
<td>36</td>
</tr>
</tbody>
</table>

From Table 2, none of the four main visit types, Heart Failure (HF) – New Patient (NP), HF-Return Visit (RV), Electrophysiology (EP)-NP, EP-RV, have standardized clinic visit processes. This conclusion means that patients arriving for appointments at the HF or EP clinic will not always a standard list of providers. A nonstandard list of providers diminishes the effectiveness of a scheduling grid as described in Table 3.
Table 3: Effect of non-standard list of providers on the effectiveness of the scheduling grid

<table>
<thead>
<tr>
<th>Situation</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>More auxiliary providers consult patients than the grid scheduled for</td>
<td>The scheduled grid underestimates the time required to complete a patient's visit. The clinic will run behind because the actual consult time for every appointment will be greater than scheduled for; clinic will run progressively more behind with every appointment.</td>
</tr>
<tr>
<td>Fewer auxiliary providers consult patients than the grid scheduled for</td>
<td>The scheduled grid overestimated the time required to complete a patient's visit. Patients will arrive at greater time intervals then optimal, which may lead to physician idle time if the physician has to wait for patients to arrive.</td>
</tr>
</tbody>
</table>

Recommendations for improving scheduling grid effectiveness

First, all physician should decide on the meaning of the scheduled appointment start time for their patients. In the best case, all physicians should decide the scheduled appointment start time to be the time patients should arrive for their appointment. In the case that the physician decides the scheduled appointment start time to be the time patients should be seen by the physician, each patient should be asked to arrive early for their appointment, allowing enough time for all auxiliary providers to complete their consultations by the appointment start time. The latter case will require more workload for scheduling staff because the amount of time required for each patient to arrive early will differ for each clinic, visit type, and physician.

Second, the appointment scheduling grids should be revised for all interested physicians individually because each has a unique natural consult time. The scheduled appointment durations should realistically reflect the time required to complete a patient’s visit. The findings in this report should provide a good starting point in estimating the actual consult of the auxiliary providers. The data collected in this project is not sufficient to accurately estimate the treatment patterns of individual physicians due to the low sample size collected for each physician. Further data collection should be pursued specifically on each physician’s treatment time.

Third, a simulation model (in Microsoft Excel or more sophisticated software such as ProModel) should be created of each physician’s clinic before deciding on revised grid setups. The model should be used to find the optimal scheduled duration of each appointment type (i.e. New Patient, Return Visit) and mix of controlled overbooking and open grid slots. Optimization of the scheduled appointment duration may increase the number of patients a physician can consult.
within the same amount of time, as will be discussed in the improved grid in the next section. The constraints of the simulation model should be to minimize both the expected wait time for each patient and the likelihood that the physician will be idle. The model could also be used to reveal the effect of overbooking, in a non-strategic way, on patient wait times in a theoretical setting. The project team has not collected data on the effect of overbooking appointments. Further data collection should be pursued in this area to establish the effect of overbooking in the clinical setting.

Lastly, variability (in consult times for the same visit type, number of providers to consult a patient) degrades the effectiveness of the scheduling grid and ultimately the performance of the clinic. Management should strive to standardize the clinic visit processes in order to reduce the effect of this variability. If standardization is not possible, the clinic visit process must be buffered with a combination of:

- Number of patients in queue (waiting to be consulted)
- Capacity (more clinic days per physician; delegate some physician tasks to NP’s and PA’s)
- Time (increase patient wait times)

The simulation model described in the previous point should be used to find the optimal buffering strategy.

A summary the team’s aforementioned recommendations for improving the scheduling grids is given in Table 4.

Table 4: Summary of grid change recommendations

<table>
<thead>
<tr>
<th>Area with room for improvement</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interpretation of the scheduling grid</td>
<td>In the optimal case, all physicians should decide the scheduled appointment start time to be the time patients should arrive for their appointment.</td>
</tr>
<tr>
<td>Setup of the scheduling grid</td>
<td>The scheduled appointment durations should realistically reflect the time required to complete a patient’s visit.</td>
</tr>
<tr>
<td></td>
<td>Scheduling grids should be revised for all physicians individually because each has a unique natural consult time.</td>
</tr>
<tr>
<td>Limited appointment capacity for physicians</td>
<td>A simulation model should be created of each physician’s clinic. The model should be used to find the optimal scheduled duration of each appointment type (i.e. New Patient, Return Visit) and mix of controlled overbooking</td>
</tr>
</tbody>
</table>
and open grid slots. Grid optimization often increases the appointment capacity for physicians.

### Non-standard availability of auxiliary providers

<table>
<thead>
<tr>
<th></th>
<th>Standardize the clinic visit processes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>If standardization is not possible, buffer clinic visit process with a combination of:</td>
<td></td>
</tr>
<tr>
<td>• Number of patients in queue (waiting to be consulted)</td>
<td></td>
</tr>
<tr>
<td>• Capacity (more clinic days per physician; delegate some physician tasks to NP’s or PA’s)</td>
<td></td>
</tr>
<tr>
<td>• Time (increase patient wait times)</td>
<td></td>
</tr>
</tbody>
</table>

### Improved scheduling grid example

The team created a simulation model of an EP (Electrophysiology) physician’s clinic following the team’s recommendations for improved scheduling grid effectiveness. A screenshot of the simulation model is shown in Image 2.

**Image 2: Excel simulation model used to optimize scheduling grid setup**

The clinic was simulated using 50 replications (not shown). The model was used to find the optimal appointment durations for each visit type (new patient and return visit) and appointment start times to minimize the patient wait times and reduce the likelihood that the physician will be idle. The translation of the simulation model into a scheduling grid format is shown in Table 5.
Table 5: Current and improved grid setup based on simulation results. In the improved setup, the dark shaded area represents the physician consult time while the light area represents the consult time by another provider.

The improved design follows a parallel structure, which takes advantage of all the rooms the physician has available for use (in this case 3). The appointment durations were optimized using actual treatment times extracted from the collected data. Strategic overbooking was used for every appointment: if the three columns (Room1-Room3) were condensed into one, all appointments would overlap. This setup, however, takes advantage of parallel processing – while one patient is consulted by the physician, a second patient may be roomed and consulted by another provider in time for the physician to become available. The benefits of this improved setup are:

- Increased physician appointment capacity by 57%
- Reduced patient wait time by 43%
- Reduced variation in patient wait time (standard deviation) by 64%.
The expected patient wait times with the improved setup is shown in Chart 22. The reduced variation as compared to the current grid setup is shown in Chart 23. The simulation predicts 7% chance that the physician will be idle at any time with an average idle time of 3 minutes (in the case that the physician is idle).

Chart 22: Expected patient wait time of the improved setup

Simulation results found by project team 11/22-12/4, 50 replicates
Chart 23: Reduced variation in patient wait times

The simulation results are meant as an example to illustrate the team’s recommendations for improving the scheduling grid effectiveness. This example is not meant to be applied in its current form due to the low sample size of collected data. Like previously mentioned, each physician’s scheduling grid should be analyzed and modeled individually. Data should be further collected to establish the treatment pattern of each physician with statistical significance. Also, the effectiveness of the scheduling grids will always be worse in practice than predicted by simulation due to the likelihood of unforeseen circumstances negatively impacting the clinic, such as physicians arriving late to clinic, last minute appointment cancellation, unavailability of patient records etc.

n=14, patient visit data collected by team 10/11-11/5, simulation results found by project team 11/22-12/4, 50 replicates
Visual Management Tool

The recommendations for a visual metric system to monitor patient wait times in real time were a secondary goal of the project. Due to the time constraints of the course, team developed a few high level recommendations for monitoring patient wait times. The team spent the majority of the semester working on data collection, data entry, data analysis, and grid scheduling effectiveness. Therefore, the team didn’t have enough time to work on the recommendations and the implantations of the visual management tool.

- Times could be placed on exam room doors that display the time since the patient was last consulted by a provider (patient wait time)
- The timers should be placed outside each exam room
- A light on the timer could blink every 15 minutes to notify the medical assistants (MAs) that the patient is still waiting. MAs should updated the patients every 15 minutes on the expected wait times for the provider

The timers are cheap and simple to operate.

Another option would be to display a “Visit Status Board” at each reception desk. This board should display the expected wait times for each physician. Such a display would give the patients an estimate for when their consultation will begin. An example of such a board is given in Figure 24.
Figure 24: Visual Status Board example

Source: Oklahoma University Medical Center

**DISCLAIMER:**

The team followed *Confidentiality and Protected Health Information (PHI)* rules. The report includes only summary information and does not include any protected health information (PHI).
<table>
<thead>
<tr>
<th>APPENDICES</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appendix C: Process Flow Map of CVC HF Clinic Visit Process</td>
<td>42</td>
</tr>
<tr>
<td>Appendix C: Patient Time Study Form (Front Side)</td>
<td>43</td>
</tr>
<tr>
<td>Appendix D: Patient Time Study Form (Reverse)</td>
<td>44</td>
</tr>
</tbody>
</table>
Appendix B: Process Flow Map of CVC EP Clinic Visit Process

1. **Patient Arrival at CVC**
2. **Patient checks in at Reception**
3. **Patient Vitals Recorded by Medical Assistant**
4. **Patient is roomed by Medical Assistant**
5. **EKG done by Medical Assistant**

At the first decision point, patients are classified into two categories:

- **New Patient**
- **Return Visit**

**New Patient**

- **Type of Visit**
  - **Patient seen by Registered Nurse (RN) or Nursing Practitioner**
  - **Patient seen by Doctor**
  - **Additional Testing (if required)**
  - **Patient Check Out**

**Return Visit**

- **Type of Visit**
  - **Patient seen by Doctor**
  - **Patient Check Out**

- **Patient seen by Registered Nurse (RN) or Nursing Practitioner**
  - **Patient Check Out**
Appendix C: Process Flow Map of CVC HF Clinic Visit Process

1. Patient Arrival at CVC
2. Patient checks in at Reception
3. Patient Vitals Recorded by Medical Assistant
4. Patient is roomed by Medical Assistant
5. EKG done by Medical Assistant
6. Type of Visit
7. New Patient
8. Return Visit
9. Patient seen by Registered Nurse (RN) or Nursing Practitioner
10. Patient seen by Doctor
11. Flu Shot by Medical Assistant (if required)
12. Patient Check Out

For New Patients:
- Type of Visit
- Patient seen by Doctor
- Flu Shot by Medical Assistant (if required)
- Patient Check Out

For Return Visits:
- Type of Visit
- Patient seen by Doctor
- Flu Shot by Medical Assistant (if required)
- Patient Check Out
Welcome to the CVC Clinic! To better serve you, we are working to improve the flow of our clinic and reduce wait times for the services we provide. To accomplish this we need your help!

On the reverse you will find the time study pictured here. This page contains directions on how to fill it out.

**Directions:**

- Identify the providers that come to see you and note if the doctor orders additional testing for your current visit. Please ask the provider if you are not sure of his/her title.

- Note when the provider enters and leaves the room using the clipboard clock.

- Provide feedback on your satisfaction with your appointment today at the CVC:

**PRIVACY NOTICE:** All information you will provide will remain confidential and anonymous. The results of our study will only display trends in clinic wait times and will not identify any participant individually.

---

Please flip the page. The time study is on the reverse.
Appendix D: Patient Time Study Form (Reverse)

CVC CARDIOVASCULAR MEDICINE CLINIC
WAIT TIME STUDY

We are working to reduce wait times in the CVC Clinic. We need your help to do this!

Directions: Please record the title or name of each clinician that comes to see you and the time they enter and leave the room. All sections are important and will help us improve our service. Upon your visit completion, please leave this sheet at the check-out desk. Thank you!

<table>
<thead>
<tr>
<th>Activity</th>
<th>Area</th>
<th>Provider</th>
<th>Time With Patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height/Weight/ BP</td>
<td>Vitals Station</td>
<td>Medical Assistant</td>
<td></td>
</tr>
</tbody>
</table>

Time placed into exam room: _____

<table>
<thead>
<tr>
<th>Provider Interaction 1</th>
<th>Exam Room</th>
<th>EKG by Medical Assistant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Doctor (MD)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fellow</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Resident/Med Student</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Testing Requested</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flu Shot</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Provider Interaction 2</th>
<th>Exam Room</th>
<th>Other Room</th>
<th>Registered Nurse (RN)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Doctor (MD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fellow</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Resident/Med Student</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EKG</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flu Shot</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Provider Interaction 3</th>
<th>Exam Room</th>
<th>Other Room</th>
<th>Registered Nurse (RN)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Doctor (MD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fellow</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Resident/Med Student</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EKG</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flu Shot</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Provider Interaction 4</th>
<th>Exam Room</th>
<th>Other Room</th>
<th>Registered Nurse (RN)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Doctor (MD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fellow</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Resident/Med Student</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EKG</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flu Shot</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Time left exam room at the end of visit: _____

Check out: ☑️

Please rate on a scale of 1 to 5 (1 being the lowest, 5 being the highest) how satisfied were you with:

- The quality of your appointment: 1 2 3 4 5
- The timeliness of your appointment: 1 2 3 4 5

What worked well during your clinic visit?

What part of your clinic visit could be improved?

Your feedback will help us improve our service. Thank you!