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Executive Summary

The Urology Clinic in the Taubman Center at the University of Michigan is concerned with the current patient flow. It is believed that a large percent of patients are not in the exam rooms at their scheduled appointment times leading to untimely service and delays in provider clinics. As a result, the needs of patients, providers, physicians, nurses, residents, and other clinic staff are not being met. Mrs. Eversole, the urology clinic administrator, hired our team to observe and conduct time studies on the patient flow in the urology clinic. The goals of the project are twofold; first, to use time study data to construct value stream maps as a means of identifying bottlenecks within the patient flow. The second goal was to identify common causes for patients not being in an exam room at their scheduled appointment time, which is thought to cause delays.

The purpose of this report is to identify the most common occurring reasons for patients not being in the exam rooms at their scheduled appointment time. The results of this report will aid in the initial stages of implementing a lean quality plan to improve the trend in patient flow in the clinic. In this report, our team will recommend changes to reduce inefficiencies and improve patient flow in the Urology Clinic.

Methodology

The project was completed in stages: data collection, data analysis, results and conclusions, and recommendations.

Literature Search

Our team conducted a literature search for previous clinic flow studies analogous to this project in the urology clinic. An informal study was conducted by one of the clinic providers, Dr. Taub. Our team used the raw data to identify preliminary potential root causes of the patient flow inefficiencies. However, due to insufficient sample size and incomplete data, the results are not robust.

Our project coordinator provided a data collection sheet used in a time study conducted by Mary Duck, Senior Management Consultant in UMH Program and Operations Analysis. This data collection sheet is in the form of check boxes, which is an efficient way to collect the data necessary and requires minimal effort from clinic staff. The data collection sheet used in our study was based on the structure of the data collection sheet used in the project conducted by Mary Duck.

Observations and Interviews

The data collection stage began by interviewing and shadowing clinic personnel: three front providers and three techs. During these interviews, staff voiced concerns on the current patient flow and provided their recommendations for improvement. Additional observations were taken simultaneously as team members were in the clinic performing this study. Team members compiled lists of observations and interview results in order to determine key process components to measure, the materials needed to perform the time study, and potential causes for inefficient patient flow.
Time Study Data Collection
Team members and clinic staff performed time studies on 153 patient visits for analysis. Team members collected data on whether new patients received and completed the new patient questionnaire and whether patients, new or returning, brought an updated list of medications. Team members also recorded the patients’ clinic entry time; check in time; and times leaving and returning from radiology, blood lab, and the bathroom. Nurses, techs, and providers recorded the time the patient was called from the waiting room to an exam room and the times and reasons that staff entered and exited the patient’s room. At the end of the visit, the patient carried the data collection sheet to the front desk staff, who then recorded the time the patient checked out of the clinic and stored the completed forms in a folder. Completed data sheets were collected on a daily or every other day basis.

Data for the 153 visits on which data was collected was entered into Excel worksheets organized by appointment specific data on one worksheet and visit specific data on a second worksheet. This data was manipulated and stratified to create value stream maps detailing process and wait times in the system and to calculate delays caused by an activity such as: KUB or blood drawn, urine sample, add-on activities, etc. Access was used for stratification of the data by day of week and appointment time.

Results and Conclusions
The observations and time study data was analyzed according the above methodology. The subsequent results and conclusions are outlined below.

Interviews and Observations: Initial supports Historic Results
Observations and interviews conducted by team members at the start of this study confirm the historical results provided by our client at the outset of the project. The historical data was analyzed and some key times were confirmed through the time study conducted by our team. Key findings include: front desk staff cannot always identify patients requiring pre-exam procedures; patients and providers arrive late; and patients are not reminded to arrive early to allow for parking, paperwork, and pre-exam testing.

Bottlenecks Identified in the Value Stream Map
Process and wait times were calculated for most activities and intervals documented during a patient visit. The value stream maps can be referenced in Appendices B, C, and D for average, worst, and best case scenarios, respectively. The bottlenecks identified in the average value stream map are wait times prior to: room placement and vitals, the first exam or treatment encounter, subsequent exam or treatment encounters, and add-on activities. There is a median wait time ranging between 9 and 14 minutes at each of these points, culminating in a large percent of the visit being non-value added to the patient or provider and clinic staff.
Causes of Delays
The time study data confirms the historic and initial observations that delays are a result of patients arriving late, requiring a KUB or blood drawn, and collecting a urine sample. It was found that 21% of patients arrive late, delaying their room placement a median time of 21.5. Patients requiring a KUB or blood testing are delayed a median time of 36 minutes out of a sample size of 7 visits. There were 6 patients not available to be taken back to an exam room because they were in the restroom the first time the flow tech called them delaying their being taken back to a room a median of 11 minutes.

An additional delay is caused by patients being taken back to an exam room prior to completing all necessary pre-exam testing. This was accounted for in a sample size of 7 patients with a median duration of 12 minutes. This not only delays the provider clinic but also takes up room allocation while not technically in use.

Recommendations

Based on the analysis of the data our team collected, we have the following recommendations for improving the patient flow in the urology clinic and increasing the number of patients in their exam room at their scheduled appointment time.

Standardization and Reconfiguration of Front Desk
Based on our findings, many clinic delays and inefficiencies began with pre-exam testing, patient arrival times, and incomplete paperwork. To reduce this, we recommend that front desk staff be given additional training to standardize their daily tasks at check-in to more clearly identify pre-exam testing needs; at check-out to more clearly define future pre-exam testing needs; and while making appointment reminder calls to convey specific standardized arrival times based on pre-exam testing, the need for updated list of medications, and the need for new patient questionnaire to be completed. Another recommendation is to reconfigure the front desk check-in and check-out areas to reduce congestion from both clinic staff and patient traffic.

Equitable Room Allocation
We recommend that room allocation be more flexible between providers. Rather than assigning a specific number of rooms for one provider, if room sharing were an option, than during downtimes in one provider clinic, overflow from another provider clinic could use the open space. This flexibility would decrease delays due to lack of room availability in a provider clinic.

Standardized Criteria for: Add-On Activities, Pre-Exam Procedures, and Scheduling
We recommend standardizing the requirements that patients must fill to qualify for various pre-exam procedures and add-on activities among all provider clinics. We also recommend requiring consistent scheduling of patients throughout the day, rather than all arriving on the hour. Standardizing these practices for all clinic providers will reduce front desk staff confusion and allow them to more easily start patients through the system.
Introduction

The Taubman Center Urology Clinic within the University of Michigan Health System (UMHS) has developed into one of the premier clinical Urology programs with state-of-the-art medical care in the nation, and thus receives patient volumes that are at or exceed capacity.

Recently, concern has surfaced around the current trend in patient flow in the Urology Clinic. Clinic staff and administration believe that a large number of patients are not in the exam rooms at their scheduled appointment times. As a result, the needs of patients, providers, physicians, nurses, residents, and other clinic staff are not being met. This perceived problem is believed to cause untimely service for patients and their families, long wait times, continued inefficiencies in the clinic, loss of potential revenue, provider and staff frustration, delayed provider clinics, and high employee turnover. While many factors could contribute to these problems, the Department would like to identify the most common occurring issues.

In response to this problem, the Clinical Administrator of the Urology Department assigned our group to identify and analyze the root causes of the problem in the clinic flow process and assist in the initial stages of implementing a lean quality improvement plan to reduce inefficiencies and improve process flow in the clinic. From our conclusions, we will recommend changes to reduce inefficiencies and improve process flow in the Urology Clinic at The University of Michigan Hospital. This report presents the findings from January 17, 2007 through April 12, 2007.

Background

The Urology Clinic in the Taubman Center at the University of Michigan Hospital is one of seven clinics area-wide that provides care to patients with common and complex urologic problems. Satellite clinics are located in Briarwood, Brighton, and Livonia. The Taubman Clinic is the main clinic and home to the in-house call center that processes all calls. The call center determines the appropriate clinic location for the patient based upon geographic location and medical needs.

Patients are normally seen at the Taubman Center Clinic between 8:00 a.m. and 5:00 p.m., Monday through Friday; however, the clinic may open early or close late to meet specific patient needs. The number of doctors, medical assistants, technicians, and nurse practitioners working per day varies based on patient demand and provider clinic availability. Normally, a provider will work one or two days per week at the Taubman Clinic. During the rest of his or her schedule, a provider will provide classroom instruction, perform research, work in the operating room, or visit other satellite locations throughout the week. Medical assistants average four to five days of work per week at the Taubman Clinic.

The clinic layout also changes from day to day due to room sharing with neighboring departments. Some procedure and examination rooms are permanent, while additional
exam rooms are determined solely based on patient volume trends from the previous year. Often, with rooms being scarce, a room is not available or equipped for nurses to teach at-home procedures to patients.

Currently, one tech or medical assistant is assigned to work the flow position in which he or she transports patients from the waiting area to exam or procedure rooms. Once in a room, the individual working the flow position will normally record the patient’s baseline vital signs and then notify the provider that the patient is ready to be seen. The remaining techs and medical assistants work in the lab or are assigned to a doctor or nurse practitioner and assist during examinations and procedures.

With a recent increase in complaints about the clinic running behind schedule from both providers and patients, focus has shifted to patient flow in the clinic. In response, one of the providers conducted a short study on the patient process through the clinic. He collected times at crucial stages in the process and looked at elements such as the need for a urine sample or Kidneys, Ureters, and Bladder (KUB) X-ray that could cause delays. After identifying some potential root causes of the problem, a forum was conducted where employees brainstormed and voiced their opinions.

The consensus that emerged from this study and meeting is that poor patient flow throughout the clinic is causing too many patients to not be in their exam room at the scheduled appointment time. Consequently, it is believed that the clinic is running behind schedule on a regular basis, which is creating a stressful work environment. However, due to time constraints, the study was never completed. The hope is that this project will build off the previous study by determining the root causes of the problem and providing sufficient data to develop recommendations for improving patient flow in the clinic.

**Current Situation**

Two changes were implemented in the Urology clinic since the start of our study. The first change was an addition of “Computers on Wheels,” COWS, which are for nurse and tech use only. The COWS are kept in the hallway outside of the staff lounge to allow nurses and techs to enter patients’ Problem Summary List (PSL) data in the exam room immediately following the patient’s verification of PSL data. The second change was the clinic began using a patient friendly medicine list, which allows the patient to verify their current medications, rather than having to list each name and dosage from scratch. The effectiveness of the COWS is taken into account in the recommendations section. The patient friendly medicine list does not affect our project.

The Urology clinic administration is currently underway with a lean project. Results from our project are being used in the value stream map in Phase 1 of the lean project.

Currently, providers leave exam rooms to print and retrieve prescriptions. Clerical staff use two printers located in the check-in and check-out area. An additional two printers are allocated for provider and tech use in the staff room.
Key Issues

The following key issues are perceived as driving the need for this project:

- Urology clinic activities are consistently behind schedule
- Service to patients can be rushed and unfriendly
- Providers idle for long periods of time (high-low periods of patient volume)
- Delays create a backlog of patients
- Providers feel as though they are always working to catch up
- Provider, nursing, clerical, and medical assistant frustration
- Rushed service increases the possibility for error

Project Scope

The focus of this project included only tasks and activities associated with the patient flow in the Taubman Urology clinic. We were not concerned with patient flow or other activities in the other satellite clinics. In terms of this project, patient flow begins when the patient enters the Urology clinic check-in line and ends when the patient exits the checkout line.

Any task in the Taubman Urology clinic not connected to patient flow was not included in this project. Specifically, we did not study tasks or activities associated with procedures in exam rooms. Any patients receiving treatment outside the Urology clinic were not considered in this study, although at times patients from other clinics may share rooms with the Urology clinic. This study excluded the process of collecting and processing urine samples as well as having a KUB taken. For our purposes, we simply documented the time spent at each activity. In addition, we did not study any costs or financial gains that might occur as a result of this analysis.

Methodology

The project was completed in two phases: data collection and data analysis.

Phase 1: Data Collection

To determine the underlying causes of the inefficient patient flow in the clinic and provide recommendations for improvement, we collected both qualitative and quantitative data.

Literature Search

Our team conducted a literature search for materials on previous clinic flow studies analogous to this project in the Urology clinic. The results show that no formal studies were performed in the Taubman Urology Clinic, so there is no existing information on the best performance levels achieved in the clinic. However, an informal study was performed by one of the clinic’s providers, Dr. Taub (See Appendix A). Following our client meeting on January 29, 2007, Dr. Taub provided our team with the data collected
from his informal study. In addition, the clinic administrator, Mrs. Eversole, presented us with results of interviews with clinic staff members, which occurred before our project began.

Our project coordinator provided a data collection sheet used in a project conducted by Mary Duck, Senior Management Consultant in UMH Program and Operations Analysis. This data collection sheet used by clinic staff is in the form of check boxes, which is an efficient way to collect the data necessary and requires minimal effort. The data collection sheet used in our study encompasses the structure of both data collection sheets used in the projects conducted by Mary Duck and Dr. Taub.

**Initial Interviews and Observations**
Team members were given a tour by a medical assistant to become more familiar with the clinic layout and operations. During the tour, team members were introduced to staff, learned the basic responsibilities of each member, and informally interviewed the staff to gain perspectives on the patient flow in the clinic. Following the initial tour, team members interviewed three providers and three medical assistants and shadowed three patients through the entire process. From these observations and interviews, team members determined the key process components to measure, the materials needed to perform the time study, and potential causes for inefficient patient flow.

**Time Study**
The team performed a two-week time study on the patient flow in the Urology clinic. The data collected from the time study has been analyzed to identify bottlenecks and inefficient processes to identify ways to improve patient flow.

**Creating the data collection sheet.** Team members and staff used a data collection sheet to collect individual patient information and time study data (See Appendix B). From our observations, feedback from staff, and literature search results, team members determined the necessary data to collect. Our team utilized the front side of the sheet to capture data, while the Urology clinic staff used the reverse side to collect data. Our team collected the following data for each patient visit:

- Appointment time
- Line arrival time
- Check-in time
- EWS arrival time
- Time(s) flow tech calls patient in waiting room
- Type of patient: new or return
- Did patient bring a list of their current medications?

When appropriate the following data was collected for patients:

- Time patient left to use restroom to give urine sample
- Time patient returned from giving urine sample
- Time patient left to get a KUB or blood drawn
- Time patient returned from getting a KUB or blood drawn
• Did new patient receive questionnaire, and if so, is it filled out?

Clinic staff members collected the following data for each patient visit:

• Type of staff member interacting with patient in room: provider, nurse, tech, student or resident
• Type of activity occurring in room: office visit, vitals, H and P, procedure, education, other
• Type of room: exam, treatment, FUDS, consultation
• Type of activity: scheduled or added on?
• Time in room
• Time out of room
• Reason for leaving room: print prescription, print forms, item not in room, end of visit, other

Note: An add-on activity is scheduled by a provider for a specific patient during the patient’s scheduled appointment with that provider. An add-on activity is defined to be an extra activity “added on” to this visit on top of what has been scheduled during the time allotted for this visit.

**Piloting the data collection sheet.** Our team piloted the data collection sheet for two days prior to conducting the two-week time study. Our team recorded data and any additional comments on the data collection sheets. We then examined the piloted data collection sheet and identified a few minor adjustments so the sheet would prompt the data collectors to collect pertinent data for credible results. Our team altered the format of the data collection sheet itself; specifically, we added the “Student/Resident” check option under the Provider column on the back side.

**Training the staff.** The members involved with collecting time study data included; our project team, the providers, nurses, technicians (medical assistants), clerical staff working check-in and check-out desks, and residents or students in training. A week prior to the start of the data collection period, our team sent an email to the Urology clinic staff participating in the study. This email notified the staff of our project, included the data collection sheet, asked the staff to participate in the time study by collecting data on the back side of the sheet, and noted the staff’s value of participating in the time study (See Appendix G). The team met and talked in person with clinic staff members regarding the data collection sheet and answered any questions that arose.

**Determining a Sample Size.** A sample size of at least 50 is necessary to make statistically significant recommendations. Our team found that data could be collected on between 10 and 40 patients per day. After 9 days of data collection, our team had 153 valuable data sheets to analyze. This is sufficient to make statistically significant and credible recommendations.
Phase 2: Data Analysis

During this phase, our team analyzed preliminary results from the historical interviews and data collected by Mrs. Eversole and Dr. Taub, the clinic administrator and provider, respectively. Additionally, our team analyzed results based on the observations, interviews, and data collection performed by our team from February 12 to April 12, 2007. We used the following statistical analysis programs to examine the data; Microsoft Access, Microsoft Excel, and Minitab14.

Initial Interviews and Observations
Team members compiled a list of observations and discussed which observations were most relevant to patient flow or a less stressful work environment. Staff interviews were also compiled by team members. Team members analyzed the compiled lists of observations and interviews to determine the key process components to measure, the materials needed to perform the time study, and potential causes for inefficient patient flow.

Tabulating Data
The data collected from the time study has been analyzed to identify bottlenecks and inefficient processes to identify ways to improve patient flow. The data was compiled into an Excel spreadsheet with the front side of the data collection sheet on one worksheet and the back side of the sheet on a separate worksheet. In both worksheets, each row represented a different patient visit that captured key times and pertinent information. The columns categorized: the time activities occurred, the duration of activities, and other vital information (i.e. new patient or not?).

Team members used the following convention when entering times into the spreadsheet; a patient’s appointment time was time zero, time prior to the scheduled appointment was negative, and time after the scheduled appointment time was positive. All numbers were collected and reported to the whole minute, though calculations done with these values are calculated to one decimal place.

Team members manipulated the Excel worksheets to perform stratification analysis and clinic-delay calculations. The data worksheets were also imported into Access for stratification analysis by appointment date and time. Next, key pieces of data were pulled for each patient on specific tasks and imported into additional worksheets that were created to analyze the following:

- The total time a patient spends in the clinic (Line arrival at check-in to exiting clinic)
- The percent of time patients arrive earlier than their scheduled appointment time
- The percent of time patients arrive at their scheduled appointment time
- The percent of time patients arrive after their scheduled appointment time
- The percent of new patients who arrive with their new patient questionnaire completed
- The percent of patients who arrive with a updated list of their medications
• The time it takes a patient to give a urine sample
• The time a patient is waiting in the lobby
• The total time a patient is waiting in the system
• The percent of time providers request an add-on activity and its impact of the duration of a visit
• The percent of patients that are in the exam rooms at their scheduled appointment times
• The time between line arrival and EWS arrival
• The duration of each activity (i.e. getting a KUB or a H&P, waiting in exam room for providers)

In all cases, ranging from the time spent waiting in the check-in line to the time spent checking-out; we generated a statistical summary on the duration of each activity. Team members focused on the median, mean, and standard deviation for the length of each activity, looking for variability and influence of potential outliers.

Note: The sample size used to calculate different activity durations varied according to the number of occurrences observed out of the entire sample size of 153 patients. Furthermore, some data and times were lost because data collection sheets were incorrectly filled out or missing data at certain stages during a patient’s visit.

Creating the Value Stream Maps
Our team created a process flow diagram of a patient’s visit in the Urology Clinic in the form of a value stream map (See Appendix C). The value stream map was based on observations at the clinic, interviews with staff, and numerical results calculated from our team’s time study. We separated a patient’s visit into the following main components:

• Greeting time
• Pre-exam procedure: KUB/lab, urine sample
• EWS arrival
• Room placement and vitals complete
• Exam/treatment
• Add-on activity
• Checkout

Patients’ visits to the clinic vary depending on any tests they may require, therefore, decision points have been included to delineate between the various paths in the value stream. The decision points are whether the patient requires:

• A pre-exam procedure: KUB/blood tests, urine sample
• An add-on activity

To arrive at the values needed in the map for each activity, we used the tabulation method discussed in the previous section. We began by calculating the time patients take to get through the entire process, and then we broke the time down into specific task times and
entered it into a statistical analysis program, Microsoft Excel. The mean, median, and standard deviation of each activity is reported on the value stream map found in Appendix C.

To further investigate patient visits and activity durations, our team looked at the best 10% and worst 10% of cases to determine the average length of a patient visit in both a best and worst case scenario. The team also looked at each activity separately. The percent of cases considered for each activity, varied due to the nature of some sample sizes but stayed at 10% when sufficient data was available. The non-value added time seen on both of these value stream maps was determined using the average percent of time a patient spends waiting during a visit, calculated for the original value stream map depicting the averages for all patients. This average percent is used because data is insufficient for worst and best case scenarios.

**Performing Graphical Analysis**

The findings from tabulating all the data in Excel were used to create different types of graphs to better summarize and enhance our results. Pie charts were used to: (1) display the percentages of patients arriving before, at, and after their scheduled appointment times, and (2) determine the effectiveness of the New Patient Questionnaire. Scatter plots were employed to show the distribution of times associated with getting a KUB, giving a urine sample, and visit durations with add-on activities. Lastly, custom stock charts were used to display the impact scheduling has on the time a patient gets into an exam room on both low and high volume days.

**Results and Conclusions**

The observations and time study data was analyzed according to the above methodology. The subsequent results and conclusions are outlined below. These results and conclusions listed below aim to quantify areas of poor patient flow by identifying bottlenecks in the clinic and other activities that lead to delays in patient care.

**Historical Interviews**

Mrs. Eversole provided results of interviews with clinic staff members to our group on January 29, 2007 (See Appendix H). These interviews have revealed the following findings on inefficient patient flow in the clinic:

- Patients arriving late contribute to inefficient patient flow
- One clerk conducting check-in causes delays
- New patients arriving without questionnaire completed causes delays
- Check-in clerk failing to send patient for urine specimen leads to delays
- Providers arriving late for clinic causes delays
- Clerks not easily determining pre-testing needs of each patient leads to patients not in exam rooms ready for providers at the scheduled appointment time
- Rooms not being available during peak times leads to a more stressful work environment
Patients taking a long time in restroom to provide urine specimen causes delays
Patients are not informed to arrive early to allow for parking, urine specimen, etc.
Empty rooms not being used because they are assigned to other providers

**Historical Data**

Dr. Taub provided data collected on 13 patients to our group on January 29, 2007. The data collection used in this study can be viewed in Appendix A. Analysis of this data revealed the findings given in Table 1 below.

<p>| Table 1: Findings of Historical Data Collection |</p>
<table>
<thead>
<tr>
<th>Sample size: 13, Collected by Dr. Taub</th>
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<tr>
<td>Average time patient spends in the clinic</td>
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<tr>
<td>Percent of patients that arrive prior to appointment time</td>
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<td>Percent of new patients that arrive with questionnaire complete</td>
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<td>Percent of patients delayed due to filling out additional paperwork</td>
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<tr>
<td>Average delay due to patients filling out additional paperwork</td>
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<tr>
<td>Percent of patients delayed due to lack of bathroom availability in the Urology clinic</td>
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<td>Percent of patients delayed due to lengthy bathroom trips</td>
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<td>Average delay due to lengthy bathroom trips</td>
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These findings indicate that a few potential root causes for patients not in their exam room at the scheduled appointment time are due to patients filling out additional paperwork and taking lengthy bathroom trips. However, the study ended before our team was asked to perform a time study. Results are not representative of the true population due to the small sample size. Therefore, conclusions can not be made on the historical data.

**Initial Interviews and Observations**

Team members determined the materials needed to perform the time study from initial interviews and observations. These materials were:

- Accurate and precise clocks stationed outside of each room
- A clip stationed by the clock outside of each room
- Enough data collection sheets printed out for each day’s use
- Writing utensils for team members to use in the waiting room
- Clipboards for team members to use in the waiting room

Team members also noted potential causes for inefficient patient flow to be:

- Patients arriving late contribute to inefficient patient flow
- One clerk conducting check-in leads to delays
- Check-in clerk fails to send patient for urine specimen
- Providers arriving late for clinic
- Clerks cannot easily determine pre-testing needs of each patient
- Rooms not being available during peak times
- Patients take a longer time than expected in restroom when providing urine specimen
- Patients are not informed to arrive early to allow for parking, urine specimen, etc.

Observations made while Conducting Time Study

While conducting the time study, our team observed additional aspects of the Urology Clinic that may contribute to inefficient patient flow, not putting patients first, or a more stressful work environment. Our observations made while conducting the time study revealed the following information:

- The current arrangement of the check-in and checkout desks prohibits efficient flow and causes confusion for patients, which results in backup at these desks at very busy times (See Appendix F).
- A translator was required three times, and twice the translator arrived after the patient’s scheduled appointment time
- The COWS remained plugged in at one location for the duration of a day, which is not contributing to the potential benefits of saving the techs time
- Many patients complained that it was difficult to find a parking space
- Techs consulted team members as to the whereabouts of patients rather than calling the patient. This may have altered data concerning attempts and reason for delays in taking the patient back to an exam room
- Providers use different criteria to determine whether a KUB is necessary. This discrepancy is significant, because an unnecessary KUB may lead to delays.
- Providers use different criteria to determine the length of an appointment and to schedule the appointment times
- Providers use different criteria as reason for an add-on activity. Driving distance is not a consideration when deciding whether an add-on is necessary. Some providers’ common justifications for add-on activities are:
  - A belief that receiving an additional needed procedure during the same visit leads to that patient’s higher customer satisfaction
  - A belief that a patient’s medical condition warrants immediate action, and an add-on procedure is the quickest way to accomplish that
- Miscommunications among front desk staff lead to errors associated with patients not completing necessary pre-exam procedures prior to being taken back to their exam room. These errors resulted in delays and are at least in part contributed to insufficient training of new check-in desk staff members
- Providers often leave rooms to print paperwork and prescriptions, adding to the non-value add time spent in the clinic.
- Re-design waiting area to make it more accessible for wheelchairs.

Analysis of Patient Arrival Times
Team members conducted analysis on patient line arrival times at the clinic to determine if late arrivals were a cause for provider clinics running behind schedule. Patient arrival times were stratified into five categories; (1) patients arriving more than 15 minutes before their scheduled appointment time, (2) between 15 and 1 minute prior to the start of their appointment time, (3) at their scheduled appointment time, (4) between 1 and 15 minutes after their appointment time, and (5) more than 15 minutes after their scheduled appointment time. Figure 1 below represents the percent breakdown of patients arriving in these time intervals.

![Figure 1: Percent of Patient Arrival Times Relative to Appointment Times](image)

Sample size: 142, Dates Collected: 3/07/07-4/12/07, Collected by IOE481W07 Team10

As depicted in the Figure 1, 22% of patients arrived after their scheduled appointment times. An additional 3% of patients arrive at their scheduled appointment time and are, therefore, not in their exam room with pre-exam procedures completed. Patients arriving after their scheduled appointment times are taken to an exam room a median time of 21.5 minutes after their scheduled appointment time. Patients arriving at or after their scheduled appointment times are a cause of clinic delays.

Another factor we analyzed was the relationship between the number of patients scheduled at an appointment time and the waiting times prior to being taken to an exam room. Figure 2, below, displays this relationship on both high and low patient volume days.
Figure 2: Time in Room vs. Appointment Time Volume

Sample size: 142, Dates Collected: 3/07/07-4/12/07, Collected by IOE481W07 Team10

Figure 2 demonstrates that patients spend more time waiting to go back to an exam room on higher volume days. In addition, the graphs show that when more patients are scheduled per appointment time, patient wait times increase. Inefficient scheduling of patients creates lows and highs in patient volume which causes excessive wait times in the clinic at times. The sample patient volume is only the number of patients our team
observed during the time study, not the actual number of patients scheduled at these times.

Value Stream Maps

The average value stream map that summarizes the results found for a 142 patient sample size can be referenced in Appendix C. The first number of interest is the average time a patient spends in the entire system, from check-in line arrival to completion of check-out. The average time spent by a patient in the system is 80.5 minutes. Of the total time in the system, patients average 48.3 minutes of non-value added waiting time throughout their visit. The high percent of time spent waiting is a cause for concern.

To help explain for such a high non-value added time, we looked at the process broken down by the duration of each individual activity. Bottlenecks were identified in the average value stream map to be wait times prior to: (1) room placement and vitals, (2) the first exam or treatment encounter, (3) subsequent exam or treatment encounters, and (4) add-on activities. The median wait times ranged between 9 and 14 minutes for each of these activities, resulting in a large percent of the visit being non-value added for the patient, provider and clinic staff.

Due to the variability in the number of pre-exam activities required and the number of activities required during a visit by a patient, the length of a patient’s visit varied significantly. The average patient visit lasted 80.5 minutes but had a standard deviation of 42 minutes. Therefore, our team investigated both extremes. We looked at the best 10% of cases and the worst 10% of cases to gain a better understanding of what lead to such large variation.

The value stream map depicting the best case scenario can be seen in Appendix D. As expected, the average time a patient was in the system dramatically decreased to 32.5 minutes of which 17.6 minutes where spent waiting. The main difference is that waiting times in the lobby, exam rooms, and prior to receiving an add-on activity are all greatly reduced. Of course, the goal would be to have all patient visits be of short duration, but that is not possible because some patients have different needs. Hence, the main focus should be on the worst cases. A plausible goal is to reduce the average time for the worst 10% of cases, but also redesign the system to accommodate such occurrences without an effect on other patients’ experiences in the clinic.

The worst case value stream map can be seen in Appendix E. In the worst case scenario, a patient is spends an average of 165.0 minutes in the system. All weight times have increased significantly. Patients incur a median weight time of 40.0 minutes in the lobby before being called by flow tech. Once vitals are completed, patients have a median wait time of 43.0 minutes before the next staff member enters the room. In addition to long weights, activity duration greatly increases. The median time for the completion of a History and Physical (H &P) increases from 15 to 46 minutes. The median time for a procedure increases from 10 to 45 minutes. In the worst case, all activities take longer.
Delays due to Pre-Exam Procedures

Some patients require pre-exam procedures such as getting a KUB or collecting a urine sample. These activities require additional time prior to exam room placement in order to reduce room constraints and provider time spent on patients not ready for examinations yet.

KUB and Blood Tests
One perceived cause for delays is that check-in staff does not correctly identify patients requiring pre-exam testing, such as a KUB, blood draw, or urine sample. Patients requiring a KUB are referred to the walk-in radiology lab, also located on the second floor of Taubman Center in Clinic A, just down the hall. Because of the unscheduled nature of the clinic, patients wait a varied amount of time to get their x-ray before returning to the urology clinic. The same practice occurs when patients require blood tests. The duration of times spent getting a KUB or blood test is pictured below in Figure 3.

![Figure 3: Time Spent Getting a KUB or Blood Drawn](image)
Sample size: 7, Dates Collected: 3/07/07- 4/12/07, Collected by IOE481W07 Team10

The median process time for getting a KUB x-ray or blood drawn is 23 minutes. Figure 2 shows the outlier values for the duration of the process, because they exceed +/- 3 standard deviations. These outliers each occurred on Friday March 9th, one in the morning and one in the afternoon; however, these points do not represent a trend for
durations on Fridays. Patients who need a KUB or Blood Test Procedure spend an additional median time of 11 min. waiting beyond the KUB or Blood Test procedure. This is represented graphically below in Figure 4.

![Diagram showing delays from KUB or Blood Draw Procedures before appointment.]

Figure 4: Delays from KUB or Blood Draw Procedures before appointment
Sample size: 7, Dates Collected: 3/07/07-4/12/07, Collected by IOE481W07 Team10

Patients requiring a KUB are placed in an exam room a median time of 36 min. after their scheduled appt. time. Patients who need a KUB or blood drawn do not arrive early enough to allow time for these procedures and this causes delays in the clinic.
**Urine Sample**

Thirty-eight percent of patients were required to give a urine sample at the clinic during their visit. Of these 54 patients, there was only one outlier point, which can be removed from the statistical analysis due to special circumstances of this patient’s visit. The nature of this study did not make it possible for our team to collect information directly related to restroom availability. Figure 5 graphically represents the total time a patient spends collecting a urine sample.

![Figure 5: Urine Sample Duration](image)

Sample size: 54, Dates Collected: 3/07/07- 4/12/07, Collected by IOE481W07 Team10

The median time a patient spends giving a urine sample is $5 \pm 2$ minutes. This does not account for possible waiting time for a restroom to become available.
The majority of patients were able to collect the specimen and return to the waiting room prior to the flow tech’s attempting to call them back to an exam room. However, five patients were still in the rest room the first time the flow tech attempted to call them. Figure 6 shows the process that these patients incurred in a value stream map.

Figure 6: Urine Sample Delay
Sample size: 54, Dates Collected: 3/07/07- 4/12/07, Collected by IOE481W07 Team10

The patient’s absence caused a delay in their appointment by a median of 11 minutes before the flow tech was again able to call them back to a room. Patients who do not make it back to the waiting room before the flow tech calls them cause delays in the clinic.

Current Medication Verification

Patients are requested to bring an updated list of their medications to their visit, this list should include the name and dosage of each medication. HIPAA states that this information must be reviewed with the patient at each visit. In the past month, the clinic has implemented a Patient Friendly Med List (PFML). In this system, clerical staff print a second list of the patient’s medications and their dosages according to current clinic records. This allows the patient to confirm or update this list without tying up clinic staff. Patients are still requested to bring an updated list to verify the accuracy of the PFML.
Table 2 below represents the percent of patients who brought an updated list of medications.

Table 2: Percent of Patients Prepared with Updated List of Medications
Sample size: 104, Date Collected: 4/12/07, Collected by IOE481W07 Team10

<table>
<thead>
<tr>
<th>Had completed med list</th>
<th># Patients</th>
<th>% Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Were told to do so</td>
<td>4</td>
<td>57%</td>
</tr>
<tr>
<td>Were not told to do so</td>
<td>3</td>
<td>43%</td>
</tr>
<tr>
<td>Did not have completed med list</td>
<td>32</td>
<td>31%</td>
</tr>
<tr>
<td>Were told to do so</td>
<td>1</td>
<td>13%</td>
</tr>
<tr>
<td>Were not told to do so</td>
<td>7</td>
<td>88%</td>
</tr>
</tbody>
</table>

As Table 2 shows, only 69% of patients come with an updated list of their medications. Stratifying the group of patients that did bring their medication list, only 57% were instructed to do so through either the appointment reminder letter or phone call.

Front desk staff is responsible for calling patients 1-2 days prior to their scheduled appointment to remind them of their visit, the provider they are seeing, and the time at which they are scheduled. The calling script used can be located in Appendix I. This script does not include a reminder for patients to bring an updated list of medications, yet it is an expectation that this message is conveyed during phone call reminders.

**New Patient Questionnaire**

New patients to the Taubman Center Urology Clinic receive a New Patient Information Packet when they schedule an appointment, if it is made more than 7 days prior to the date of the visit. This packet includes information including driving directions, parking instructions, appointment day instructions, and the new patient questionnaire. If a patient has not seen a nurse or provider for three or more years, then the patient is again considered new to the system. Patients are requested to complete this form prior to arriving for their visit.
The breakdown of utilization of the questionnaire can be seen in Figure 7.

Data collection results indicate that 31% of new patients had this form completed and with them when arriving for their visit. 14% of new patients did not have this form with them because the appointment was made in the past 7 days and the packet was not mailed to them. Only 17% of new patients came to the clinic without the questionnaire filled out. Additionally, 38% of patients reported never having received the new patient questionnaire when the appointment was scheduled with sufficient lead time.

As mentioned previously, front desk staff makes reminder phone calls to patients a day or two prior to the scheduled appointment. The reminder call script found in Appendix I, does not include a reminder for new patients to bring their completed new patient questionnaire. However, an informal expectation exists for clerical staff to remind patients to bring the completed form.
Provider Metrics

Table 3 below shows metrics broken down by individual providers. During the time study, the average observed patient visits per provider was 11 visits. However, providers saw additional patients which were not captured by the time study.

Table 3: Urology Clinic Analysis per Provider
Sample size: 142, Dates Collected: 3/07/07 - 4/12/07, Collected by IOE481W07 Team10

<table>
<thead>
<tr>
<th>Provider</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent of rooms allocated per rooms allocated to clinic</td>
<td>44.4%</td>
<td>30.0%</td>
<td>38.9%</td>
<td>28.6%</td>
<td>8.7%</td>
<td>40.0%</td>
<td>26.9%</td>
<td>21.1%</td>
<td>50.0%</td>
<td>18.8%</td>
<td>28.6%</td>
<td>34%</td>
</tr>
<tr>
<td>Total observed patient visits</td>
<td>14</td>
<td>11</td>
<td>9</td>
<td>4</td>
<td>5</td>
<td>18</td>
<td>28</td>
<td>8</td>
<td>10</td>
<td>18</td>
<td>8</td>
<td>13.3%</td>
</tr>
<tr>
<td>Percent of patients in scheduled room at the scheduled time</td>
<td>35.7%</td>
<td>63.6%</td>
<td>55.6%</td>
<td>75.0%</td>
<td>40.0%</td>
<td>33.3%</td>
<td>39.3%</td>
<td>37.5%</td>
<td>20.0%</td>
<td>22.2%</td>
<td>62.5%</td>
<td>48%</td>
</tr>
<tr>
<td>Number of patients that needed a KUB or blood drawn</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.6</td>
</tr>
<tr>
<td>Number of Visits with an Add-on Activity</td>
<td>0</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2.2</td>
</tr>
<tr>
<td>Percent of Visits with an Add-on Activity</td>
<td>0.0%</td>
<td>36.4%</td>
<td>33.3%</td>
<td>0.0%</td>
<td>20.0%</td>
<td>11.1%</td>
<td>39.3%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>12.5%</td>
<td>15%</td>
</tr>
</tbody>
</table>

The percent of patients in their exam room at the scheduled time per provider ranges from 0% to 75%, which is a wide range. As was noted in observations, providers use different criteria to determine the length of an appointment and to schedule the appointment times. This difference in criteria used by providers is reflected in the backlog of patients getting to their exam room at the scheduled time. On a given day, the percent of exam rooms allocated to each provider varies. Inefficient provider room allocation and inefficient scheduling contribute to delays in the clinic.
**Add-on Procedures**

Sixteen percent of visits had one or more add-on procedure. Of these visits, clinic duration data was collected on 19. Figure 7 graphically represents the total time a patient spends in the clinic when one or more add-on procedures occur during their visit.

![Figure 7: Duration of visits with one or more add-on procedure](image)

Sample size: 19, Date Collected: 4/12/07, Collected by IOE481W07 Team10

The median duration of visits with one or more add-on is 108 +/- 57 minutes; this is represented by the upper, pink line. The median duration of all visits is 81 +/- 40 minutes, represented by the lower purple line. This is significant because it identifies that visits with one or more add on procedure are generally 27 minutes longer than the average visit. Add-on activities delay provider clinics which lead to a decrease in patient satisfaction for patients who do not receive an add-on activity but are delayed by a patient receiving an add-on activity before them.

**Recommendations**

Based on the analysis of the data our team collected, we have the following recommendations for improving the patient flow in the urology clinic, increasing patient satisfaction, reducing the Urology clinic staff stress, and increasing the number of patients in their exam room at their scheduled appointment time.
**Standardize Front Desk Training**

Front desk staff is the first defense in maintaining on-time provider clinics. Thus, by standardizing their training and responsibilities fewer patients will experience delays because all pre-exam procedures and necessary paperwork will be complete. We recommend that this training be more thorough and comprehensive. A standardized training manual should be created to cover all aspects of responsibilities and expectations of a front desk clerk.

**Reminder Calls**

Front desk staff is in charge of making reminder phone calls 1-2 days prior to scheduled appointments for most visits at the clinic. We recommend that the calling script for these reminder phone calls be updated to include more specific instructions that:

- States importance of arriving early to allow for parking and pre-testing procedures
- Clearly states to bring an updated list of current medications
- Asks to bring and complete the New Patient Questionnaire prior to arrival

To accompany the calling script, we recommend the creation of standardized arrival times for patients based on pre-exam procedure needs. During the reminder phone call, front desk staff should be able to easily determine from CareWeb what pre-exam testing a patient needs and reference a standardized table to account for how long the procedure will take. Table 4 gives the amount of time prior to the scheduled appointment time we recommended telling patients to arrive:

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Arrival Time Prior to Scheduled Appointment Time (in Minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KUB/blood work</td>
<td>45</td>
</tr>
<tr>
<td>Urine Sample</td>
<td>20</td>
</tr>
<tr>
<td>Both KUB/blood work and Urine Sample</td>
<td>50</td>
</tr>
</tbody>
</table>

The numbers in Table 4 are based on the addition of average times spent by patients for each procedure, taking into account additional waiting time, and 15 minutes for parking and traveling to the clinic. If, for example, a patient requires giving a urine sample then that patient should be told in the reminder call to arrive 20 minutes prior to their scheduled appointment time. These 20 minutes is the addition of five minutes average time spent giving a urine sample plus 15 minutes for parking and traveling to the clinic. As a result of this standardization, patients requiring a KUB, blood work, or a urine sample will know to allocate additional time for the visit without delaying the clinic.
**Standardize Recording of Pre-Exam Procedure Needs**

At the end of a visit, if an additional appointment is necessary, it will be scheduled at the check-out counter. To mitigate delays due to missing pre-exam procedures, the front desk clerk, at the time of scheduling, should include a note in the “Comments” section of the EWS scheduling system stating implicitly what testing will be required at the next visit. This training should coincide with that recommended below for identifying pre-exam procedures at check-in.

We recommend additional training for front desk staff to better acquaint them with pre-exam procedures necessary prior to arriving a patient in the EWS system and taking them back to an exam room. By identifying patients requiring pre-exam testing, patient wait times beyond the procedure time can be eliminated in the process. Also, ensuring all patients complete necessary pre-exam testing prior to be taken back to an exam room will decrease provider clinic delays and patient backlogging because there will be no empty room allocation for patients not in their exam room and ready for their provider.

**Reconfigure Check-In and Check-out Areas**

We recommend reconfiguring the front desk area by placing all check-in and out staff at the front. This would decrease congestion caused by both patients and staff walking through the corridor to where the current check-out desk is, see Appendix F for current layout. Reconfiguring the space would require front desk staff to be more versatile and able to assist with checking patients in or out to quickly dissipate a line.

**Ask Translators to Arrive Early**

It was observed that translators ran late while the patients for whom they were translating were arriving on-time. This created delays in the clinic by preventing patients from completing pre-exam procedures or being taken back to an exam room, when available. Currently translators are requested to arrive 15 minutes prior to an appointment. However, as the translators were actually running late, requesting they arrive 30 minutes prior to an appointment would mitigate delays due to their absence.

**More Equitable Room Allocation**

Providers are allocated a set number of rooms per clinic based on historical volumes, not scheduled numbers of patients. By creating a flexible schedule for room allocation based roughly on historical volumes that allow for room sharing based on current scheduling variability, fewer empty rooms would be kept aside for a provider while another clinic is running behind due to room shortages.

**Place a Computer and Printer in Each Room**

Providers must leave the patients room to print off paperwork and examine KUBs. This is inefficient because often once the provider leaves the room they can become sidetracked
by other clinic staff that need assistance. Providers leaving the room to print paperwork is non-value added because it is a time that the patient is waiting. A computer and printer should be put in each room. With this new system, providers will be able to print prescriptions and other paperwork and examine KUBs more efficiently.

**Re-evaluate use of COWS**

Two “Computers on Wheels,” COWS, are intended for nurses and techs to enter PSL data in the exam room immediately following the patient’s verification of PSL data. However, the COWS remain in one location during a day, which is not contributing to the potential benefits of saving time. Our team recommends a re-evaluation of the extent of the current use of COWS. Given the mobile nature of the COWS, it would not be difficult for nurses and techs to bring COWS into the exam rooms to enter PSL data immediately following the patient’s verification. Therefore, if COWS are deemed to be an important aspect of the clinic, nurses and techs should be further persuaded to better make use of them.

**Develop Standardized Criteria for Add-Ons**

Providers who currently schedule add-ons do so without standardized criteria. As add-ons are considered a cause of clinic flow disruptions, they should be eliminated unless absolutely necessary. Providers schedule add-ons because they believe that they increase customer satisfaction. However, the additional wait times caused by add-ons actually decreases overall customer satisfaction because the next patients have to wait longer as a result and the clinic may run behind the rest of the day. Add-ons should only be allowed for patients who live more than 180 minutes from the clinic.

**Develop Standardized Criteria for Pre-Exam Procedures**

Providers determine weather a patient needs a pre-exam procedure such as a urine sample, blood draw or KUB based on different criteria. As a result, the front desk staff becomes confused and misses sending patients to get their pre-exam procedure. By standardizing the criteria for determining when pre-exam procedure are required, front desk staff will always know which patients need to go to a pre-exam procedure upon arrival. This will eliminate waiting because when a patient does not get the proper pre-exam procedure, they often have to leave the exam room after they are brought back to it to get a pre-exam procedure.

**Develop Standardized Criteria for Scheduling**

Providers use different criteria to schedule patients. Some providers schedule multiple patients at once, while other providers have patients arrive in intervals. Providers also request different appointment lengths for the same procedure. This causes backups in the clinic because too many patients are scheduled at one time. There are also lows in the day where providers and staff are waiting for patients because there is not a high volume of patients. Using a consistent scheduling model will eliminate these highs and lows during
the day, and allow a higher volume of patients to pass through the clinic and promote a less stressful environment.

**Further Studies**

Our final recommendation is that further studies using the same data collection sheet are conducted following the completion lean project to quantify improvements.

**Expected Impact**

With the implementation of the above recommendations, our team expects to see the following impacts on the clinic:

- Reduction of patient wait times by keeping provider clinics on schedule
- Reduction of staff stress originally caused by inconsistent scheduling and provider clinic delays.
- An increase in the percent of patients arriving with necessary paperwork completed and updated.
- An increase in the percentage of patients in their exam room at their scheduled appointment time.
- Reduction of clerical errors by standardizing front desk training and procedures.
- An increase in patient satisfaction by reducing overall visit duration.
## Appendix A: Historical Data Collection Sheet

### Urology Flow Process Time Study

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Date:**
**Patient Name:**
**Provider Name:**

1. **Appointment Time:**

2. **Line Arrival Time:**

3. **Greeting Time:** ____________

   - Did the patient need to go to Radiology for KUB or Lab for blood draw:
     - Y
     - N

   - If no referral or authorization, did they sign waiver or use courtesy phone to contact PCP (circle one):

   - Did the patient present without a blue registration card:
     - Y
     - N

4. **EWS arrival time:** ____________

5. **If this is your first visit, did they receive a new patient questionnaire in the mail:**
   - Y
   - N

   a. If yes, is it completed:
     - Y
     - N

   b. If no, was this appointment made within the last 7 days:
     - Y
     - N

6. **Did patient bring in an updated list of their medications:**
   - Y
   - N

   a. If no, was the patient verbally informed to do so during the scheduling process:
     - Y
     - N

7. **Does this patient have a scheduled H & P visit today:**
   - Y
   - N

8. **Does this patient have a scheduled nurse visit today:**
   - Y
   - N

9. **Time patient returned to lobby after using restroom for urine specimen:**
   - ____________

10. **Was the bathroom available for the patient:**
    - Y
    - N

11. **Time flow tech calls patient:**
    - ____________
If time flow tech is ready is > than 5 minutes past EWS arrival time what was the delay (ask MA)?
Room availability?

12. Was patient available to go back to exam room:  Y  N
   a. If no, why?
      i. Bathroom
      ii. Ins. Issues
      iii. Registration
      iv. Interpreter
      v. Left Area
      vi. Paperwork
      vii. Other:
   b. If no, time patient actually available to go back to exam room:
      __________

13. Time arrived in exam room: __________

14. Time written on board: __________

15. Time patient is available for provider (patient may need PVR, Uroflow, pad weights, etc.):
    __________

16. Time provider enters exam room: __________

17. Ask provider if patient had all necessary tests/UA/KUB done prior to provider entering room:  Y  N

18. Time provider leaves room: __________

19. If 1st provider was resident or nurse, time attending enters room: __________

20. If 1st provider was resident or nurse, time attending leaves room: __________

21. Does this patient need to move to another room for testing? Y  N
    a. If yes, which room:  FUDS or Cysto with monitor (2721) or Treatment room
       (circle one)
    b. Time patient is ready to move to the testing room: __________
    c. Is the testing room available?  Y  N
    d. Time patient moves into testing room: __________
    e. Time provider enters room to perform procedure: __________
    f. Time patient leaves testing room to return to exam room: __________

22. H & P visit info:
    a. Was the H & P scheduled or added on (please circle)
    b. Who is performing H & P—Nurse practitioner or resident (please circle)
    c. Time patient is ready for H & P: __________
    d. Does the patient need to move to a different room?  Y  N
i. If yes, time room is ready: ___________

e. Time provider enters room for H & P: ___________

f. Time provider exits room if not performing teaching: ___________

g. Who is performing teaching—nurse or nurse practitioner (please circle)

h. If nurse, time nurse enters room for teaching: ___________

i. Time nurse or NP exits room once teaching is complete: ___________

23. Nurse visit: (please circle)

a. Was the nurse visit scheduled or added on (please circle)

b. Time patient is ready for nurse visit: ___________

c. Does the patient need to move to a different room? Y  N

   i. If yes, time room is ready: ___________

d. Time nurse enters room for nurse visit: ___________

e. Time nurse exits room: ___________

24. Time patient departs exam room/testing area for check-out: ___________

25. Time patient arrives at check-out clerk: ___________

26. Time patient leaves clinic: ___________
Appendix B: Data Collection Sheet

Urology Clinic Flow Process
Time Study

Date:
Patient Name:
Provider Name:

3. Appointment Time: ____________
4. Line Arrival Time: ____________
3. Check-In Time: ____________

Did the patient need to go to Radiology for KUB or Lab for blood draw:
Y  N

Time left Urology? ____________
Time returned to Urology? ____________

Does patient have referral or authorization? Y  N
If no, did they sign the waiver or use Courtesy Phone to contact PCP? Y  N
   If used Courtesy Phone, length of call? ____________

Did the patient present without a blue registration card: Y  N

27. EWS arrival time: ____________

28. Is this a new patient? Y  N

29. If this is your first visit, did they receive a new patient questionnaire in the mail: Y  N
   a. If yes, is it completed: Y  N
   b. If no, was this appointment made within the last 7 days: Y  N

30. Did patient bring in an updated list of their medications: Y  N
   a. If no, was the patient verbally informed to do so during the scheduling process: Y  N

31. Does this patient have a scheduled H & P visit today: Y  N

32. Does this patient have a scheduled nurse visit today: Y  N

33. Time patient left lobby to use restroom: ______________

34. Time patient returned to lobby after using restroom for urine specimen:

35. Time flow tech first calls patient in waiting room: ______________
   a. If requires multiple attempt because patient is not there, please note the attempt and time:
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Exit clinic time: ___________
Appendix C: Average Value Stream Map

Urology Clinic Patient Flow
Value Stream Map

Average total time in system=80.5 min
Average non-value added time (wait times)= 48.3 min
Average value added time=32.2 min
Appendix D: Worst Case Value Stream Map

Urology Clinic Patient Flow
Value Stream Map

(Worst Case Scenario-Based on worst 10% of cases)

Patient Enters Check-In Queue

Greeting Time
Median=4.0 min
Mean=4.4 min
St.Dev.=0.5 min

Require Pre-Exam Procedure?

NO

YES

KUB/Lab or Urine Sample?

NO

YES

KUB/Lab

Median= 59.0 min
Mean= 69.0 min
St. Dev.= 0.0 min

Urine Sample

Median= 10.0 min
Mean= 11.8 min
St.Dev.= 4.1 min

KUB/Lab

Median= 69.0 min
Mean= 69.0 min
St. Dev.= 0.0 min

EWS Arrival

Median=0.0 min
Mean=1.8 min
St.Dev.=6.9 min

Room Placement & Vitals Complete

Median=6.0 min
Mean=6.3 min
St.Dev.=0.8 min

Exam/ Treatment

(W) (medians)
Office Visit=36.5 min
Procedure=45.0 min
H&P=46.0 min
Education=39.0 min
Other=7.0 min
Wait time=43.5 min

Add-On?

NO

YES

Add-On Activity

Median=6.0 min
Mean=6.3 min
St.Dev.=1.5 min

Check-Out

Median=0.0 min
Mean=0.3 min
St.Dev.=0.1 min

Total time in system=165.0 min
Non-value added time (wait times)=108.9 min
Value added time=56.1 min
Appendix E: Best Case Value Stream Map

Urology Clinic Patient Flow
Value Stream Map

(Best Case Scenario-Based on best 10% of cases)

Patient Enters Check-In Queue

Median= 0.0 min
Mean= 0.0 min
St. Dev.= 0.0 min

Greeting Time
Median= 1.0 min
Mean= 1.0 min
St. Dev.= 0.0 min

NO

Require Pre-Exam Procedure?
YES

KUB/Lab or Urine Sample?
YES

Urine Sample
Median= 3.0 min
Mean= 2.8 min
St. Dev.= 0.4 min

KUB/Lab
Median= 17.0 min
Mean= 17.0 min
St. Dev.= 0.0 min

NO

KUB/Lab
Median= 17.0 min
Mean= 17.0 min
St. Dev.= 0.0 min

Exam/ Treatment
(Medians)
Office Visit= 2.5 min
Procedure= 2.0 min
H&P= 8.0 min
Education= 5.0 min
Other= 1.0 min

Wait time= 1.0 min

Add-On Activity
Median= 2.0 min
Mean= 2.3 min
St. Dev.= 0.6 min

Add-On?

NO

Patient Exits Check-Out Queue

Median= 0.0 min
Mean= 0.0 min
St. Dev.= 0.0 min

Urine Sample
Median= 3.0 min
Mean= 2.8 min
St. Dev.= 0.4 min

NO

KUB/Lab
Median= 17.0 min
Mean= 17.0 min
St. Dev.= 0.0 min

Check-Out
Median= 0.0 min
Mean= 0.0 min
St. Dev.= 0.0 min

Total time in system= 32.5 min
Non-value added time (wait times)= 17.6 min
Value added time= 14.9 min
# Appendix F: Clinic Layout

## Urology Clinic Layout

<table>
<thead>
<tr>
<th>Exam 732</th>
<th>Exam 731</th>
<th>Treatment Rm 2</th>
<th>Exam 40</th>
<th>Staff Lounge</th>
<th>Exam 46</th>
<th>Supply Storage</th>
<th>Visual Field 2721</th>
<th>Urology Lab</th>
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</thead>
<tbody>
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<th>Exam 43</th>
<th>Exam 45</th>
<th>Exam 47</th>
<th>Exam 49</th>
<th>Exam 51</th>
<th>Urology Staff Room</th>
<th>Bathroom</th>
<th>FUDS</th>
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<td>Exam 2</td>
<td>Exam 4</td>
<td>Exam 6</td>
<td>Exam 8</td>
<td>Exam 10</td>
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</table>

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<th>Exam 3</th>
<th>Bathroom</th>
<th>Urology Nursing</th>
<th>Exam 5</th>
<th>Bathroom</th>
<th>Exam 7</th>
<th>Desk 1</th>
<th>Desk 2</th>
<th>Patient Check-In</th>
<th>Patient Checkout</th>
</tr>
</thead>
<tbody>
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</table>

<table>
<thead>
<tr>
<th>Urology Patient Waiting Area</th>
</tr>
</thead>
</table>

Desk 1

Desk 2

Patient Check-In

Patient Checkout
Appendix G: Introductory Email Sent to Staff

Dear Staff,

As Malissa recently informed you, we are a team of Industrial Operations Engineering students doing a clinic flow study on your clinic. The purpose of our study is to analyze and document the reasons that the flow of your clinic is behind. One of our ultimate goals is to reduce the number of backlogged patients with hopes that this will reduce stress for all staff. As part of our study, we will be collecting data and we need your help to get this data. Attached is a data collection sheet that we have put together. Our team will be collecting data on the first page, then we will place the forms on the patients file. Next, the flow tech will document the time that they call the patient, and if multiple times are required, they will document the reason that the patient is not available and the additional times that they call the patient. Once the flow tech leads the patient to their room, they will clip the data collection form on the door next to a clock. We are asking that every time a staff member enters the patients room, that the document the type of staff they are (tech, provider, nurse, or resident/student), the reason they are entering the room (checking vitals, office visit, h&p, education, procedure) the room the patient is in (exam, procedure, education) and the time they enter. The system we have set up entails a row of checkboxes which will take the minimal time. Once you leave the room, please document your exit time and the reason you are leaving. We are also asking that the last person to see the patient, hands the form to the patient so that it can be taken back to front desk for our review. It is very important that we get this data because it is the only way we can complete our study and improve your work environment.

Thanks,
Audrey Dulude
Stephanie Freiwald
Rachel Kahn
Morgan Ward
Appendix H: Historical Interviews

Adult Urology Flow Process Improvement Project

Identifying the Problem

*Patients are not in exam room at scheduled appointment time.*

As a result…
- Backlog of patients
- Clinic activities run behind
- Creates a stressful work environment
- Provider frustration
- Providers feel they are constantly working from behind
- Nursing, clerical, medical assistant staff frustration
- Untimely service to patients
- Rushed, unfriendly service
- Possibility of increasing margin of error
- Need to bring patient back for procedures/testing due to time constraints
- Creates a negative perception by providers- as a result, several providers do not want to work in TC
- Overtime costs are incurred by the department
- Work/life balance difficult to obtain

Goals
- To have patients in the exam room at their scheduled appt time with all necessary prep work complete.
- To put patients and families first! We want to provide timely, friendly, professional service to all patients.
- To provide a pleasant, stress free work environment for providers and staff that is conducive to providing top notch service with a low margin of error.

Getting to the Root of the Problem
- Patients arrive early/late
- Message may be left for patient to alter appointment date/time patient may not receive/retrieve message
- Check in gets backed up with only one clerk checking in
- Patient is given multiple forms to be filled out before being called to a room
- New patients arrive without new patient questionnaire completed
- Check in clerk fails to send patient for urine specimen stat
- Patients take extraordinarily long time in restroom providing urine specimen
- Patients not consistently/appropriately informed regarding the need to arrive early for parking, urine specimen, KUB, etc.
- Clerks cannot easily determine pre-testing needs
- Provider running late
- Staff to patient ratio (flow) not meeting need
- Room availability, we need more rooms (Tuesday A.M. & Wednesday)
- PSL review of meds are often lengthy/new
- Providers not erasing names off board or changing lights
- Empty rooms may be for other providers
- Providers ask for RN teaching on same visit, therefore the RN uses the same room (taken from requesting provider)
- Continuity is having the provider look around for chart after pt has been roomed
- Current clinic communication system (walkie talkie) not meeting our needs
- Medical assistants do not have appropriate computer resources to enter patient vitals into CareWeb
- Develop and implement a consistent process of confirming all patients three days prior to appointment to include info about why…. Testing, parking, urine specimen, KUB, etc.
- Realignment of the front desk
- Re-route the printing of patient encounter forms to back clinic area
- Creation of an MA station to have one central place for forms…. Implementation of the Patient Friendly PSL
- Increase MA/Tech to patient ratio at the following times:
  - Monday 12:30 – 1:30 P.M.
  - Tuesday 7:30 – 9:00 A.M.
  - Wednesday 7:30 – 9:00 A.M.
- Seek out ways to afford staff additional training/education to enable them to discern which patients need to give urine spec. prescreening x-rays
- Have clerical staff consistently indicate on the PEF the name of procedure patient is having (top right corner)
- Problems:
  - Labels are generated via CCC upon patient arrival in EWS. We need the label for the urine specimen…
  - Demographic sheet and the AUA symptom index
  - Patient friendly PSL prints via CCC upon arrival in EWS
  - How we could incorporate walkie talkie…
Appendix I: Script for Reminder Calls to Patients

This is __________ calling from the University of Michigan Urology Center. I am calling to remind you of your appointment with ________ on (day, date, time).

Please arrive at least 30 minutes prior to your scheduled appointment time to allow sufficient time to locate a parking spot and fill out any necessary paperwork. Please be aware that you may be asked to provide a urine specimen upon arrival at our clinic.

If you cannot keep that appointment, or if you have any questions, please call us back at 734-936-7030.

Thank you.

Note: This is modified to let patients who need a KUB know that they will need to arrive a little earlier to get the KUB.