Transplant Clinic at Taubman Center
Improving Schedule and Workflow Process

Final Report

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Executive Summary

The University of Michigan Hospital’s new Transplant Clinic has been experiencing difficulties with room allocation to meet rising patient demand, inherent variability in patient type, and maintaining consistent workflow. As a result, the Research Translation Specialist at the Transplant Clinic tasked the Industrial and Operations Engineering 481 team to study the current state of the Transplant Clinic, determine alternative schedules to optimize room utilization, and improve the overall workflow of the clinic. The team used three methods to collect data about the current state and schedule of the clinic: observations and shadowing, interviews, and a visit to the Gastrointestinal Clinic (GI). From this analysis, the team developed two alternative schedules that will account for the variability in patient visits and promote better communication among clinical staff members, and increase overall patient satisfaction.

Background

The Transplant Clinic specializes in nephrology, hepatology, and surgery for transplant patients. Patient visits are categorized by pre-evaluation, evaluation, post transplant check-in, or chronic illness. There are two shifts in the clinic, the morning shift is from 8:00 AM until 12:00 PM, and afternoon shift is from 1:00 PM and ends at 5:00 PM.

Looking at Appendix A, the current schedule does not have a sufficient number of rooms to see the number of patients expected to be seen during the Tuesday AM, Wednesday PM, and Friday AM shifts. The staff also complains for having an unpredictable patient flow. For example, during the week of February 2, 2015, 138 patients were seen on Wednesday. Whereas on Friday, only 98 patients were seen in the clinic for the entire day.

Lastly, the clinical staff expressed concern with the breakdown in communication among providers. There is no central system that gives real time updates for the whereabouts for each provider and patient in the clinic. This leads to extended delays in patient rooming and visit times. With the issues described, the research translation specialist wanted the team to develop alternative schedules that will increase room utilization, improve workflow, and increase patient satisfaction.

Methods

To determine where improvements can be made to the Transplant Clinic’s schedule, the team collected data during observations, shadowing, interviews, and a Gastrointestinal Clinic visit.

- **Observations and Shadowing**: The team observed the Transplant Clinic for 36 hours and followed eight different providers. During these observations, the team gathered further information about the key issues that result from the current schedule. The team also had
the opportunity to follow three patients through the clinic to help gain a better understanding of a typical patient visit.

- **Interviews**: The team interviewed three staff members of the Transplant Clinic. The interviewees were two providers and one manager. The interviews focused primarily on identifying the key scheduling and workflow issues in the clinic and brainstorming solutions for a new clinic schedule.

- **Gastrointestinal Clinic Visit**: The Transplant Clinic staff recommended visiting the GI Clinic on March 25th. The clinic is known for running efficiently, which is why it was recommended to shadow. The team went in the clinic and observed for four hours. The team also sat in on a weekly “huddle” meeting to understand lean principles being used in the clinic.

**Findings**

The findings for each of the methods used to analyze the current state of the clinic are as follow:

- **Observations and Shadowing**: The observations and shadowing revealed the lack of a dynamic schedule coupled with communication breakdowns, lead to disrupted workflow and long patient wait times. The team saw anywhere from zero to four rooms not occupied on days that were overbooked because staff members were not aware that the room had become available. The practice of double booking was causing an already stressed clinic grid to run even further behind. Lastly, the team found that staff did not always have a good sense of room availability due to a lack of a system to track patients and rooms in the clinic.

- **Interviews**: During the interviews, the biggest problem identified was that too many providers are currently scheduled to see patients Tuesday through Thursday. The alternative schedules need to smooth out the number of patients seen during each shift and better accommodate the possibility of visits running longer than 30 minutes.

- **Gastrointestinal Clinic Visit**: The team identified two key differences between the Transplant Clinic and the GI Clinic. Firstly, the GI Clinic uses lean processes, such as team ‘huddles’. These are five-minute meetings, used to discuss potential workflow ideas or issues encountered in the clinic. Secondly, the providers in the GI Clinic are not assigned specific rooms. The MA’s print out paper with physician’s schedule for that day. Patients are tracked with a sticker with a room number on it. Once the patient checks out, the number is put into the pool of potential rooms for the next patient.

**Conclusions**

The team made three main conclusions regarding to the low room utilization and workflow issues in the transplant clinic.

- **Room Allocation**: The practice of assigning rooms to providers based on rank rather the number of expected patients to be seen is not effective in achieving higher room
utilization. The team concluded there needs to be a standardized process for allocating the number of rooms to each provider.

- **Scheduling:** The current schedule is imbalanced largely due to provider preference. Although physicians prefer not to work Mondays and Friday afternoons, the new alternative schedules to have more staff members working on these less popular days in order to stabilize demand. Also, the practice of double booking patients for a time slot needs to be discontinued. This way the clinic grid can accurately forecast the schedule for the day and providers can prepare for the day in accordance with grid given to them.

- **Communication:** The team found that the breakdown in communication among staff members could be attributed to the lack of a central tracking system. There needs to be a system that gives real time updates of the whereabouts for provider and patient in the clinic.

**Recommendations**

The team made several recommendations regarding to each of our conclusions listed.

- **Room Allocation:** In order to maximize room allocation, the team decided to assign rooms based on number of patient and patient type. If a provider is scheduled to see zero to seven patients, he or she will receive 1 room. Providers will receive two rooms for eight to ten patients and three rooms for more than ten patients. Patient type should also be a factor in room allocation because evaluation patients can be in a room for an entire shift, while check ups can take 30 minutes.

- **Scheduling:** The team created two alternative schedules for the Transplant Clinic. The first schedule has minor changes and was focused on evening out the number of patients seen during each shift with only one two providers switched on the busier days (See Appendix B). The second schedule the team made has more drastic changes by incorporating a rotational schedule on Friday afternoons. This schedule holds all providers responsible for holding more clinic hours on Fridays to balance the schedule. In both schedules there are no longer any negative “Available” rooms. The additional available rooms will be used as “on-call” rooms that can assist with unanticipated delays in the schedule. Lastly, the team recommends never to double book, no matter the doctor.

- **Workflow:** The team recommends using a large whiteboard that outlines each step of a patient’s visit to better the communication in the clinic and give real time updates of the state of the clinic. By tracking the patients visit step-by-step, clinic employees will all be able to see where each patient is, and the rooms that are being used (See Appendix D). Lastly, the team suggests the Transplant Clinic implements a clinic wide meeting weekly. The meetings will include all levels of employees, and will be focused on continuous improvement in the clinic. The meetings will allow all levels of employees to have suggestions on improving the clinic with large-scale and small-scale changes.
**Introduction**

In the fall of 2013, the University of Michigan Hospital introduced a new Transplant Clinic, located in the Taubman Center at registration desk 5. The clinic serves nephrology, hepatology, and transplant surgery patients as well as offers services for infectious diseases, dialysis, and general hepatology. Since the clinic’s opening, the Research Translation Specialist has reported difficulties with creating a schedule with yield high room utilization and smooth patient demand across all days of the week.

As reported by the research translation specialist, the clinic’s inability to effectively utilize the rooms is largely due to the variability inherent in the care for each patient’s disease. The schedule is unable to adapt to problems, such as patients arriving late or labs being delayed, in real time. Moreover, the schedule also currently allows for days to be overbooked, which leads to long patient wait times, overwhelmed staff, and overall dissatisfaction. There is a breakdown in communication among the clinical staff that is aiding in the clinic’s inability to maintain a consistent schedule on regular and overbooked days. The Research Translation Specialist at the Transplant Clinic has tasked an IOE 481 student team from the University of Michigan to study the current system to determine ways in which the room and provider schedule could be optimized to allow for higher room utilization. From this analysis, the team has developed two alternative schedules that will account for the variability in patient visits and increase room utilization. The team has also developed several workflow improvements to help the Transplant Clinic staff maintain the alternative schedules.

The purpose of this project was to analyze the current state of the Transplant Clinic, determine the factors and constraints related to scheduling, and create a new schedule that alleviates these inefficiencies. The team also developed workflow improvements that will help the clinic staff adhere to the new schedule and minimize delays in the clinic. The team examined the current clinic schedule by shadowing and interviewing the Transplant Clinic staff members. The data and information collected from these meetings was used to analyze the system and develop conclusions and recommendations for improving the schedule, patient wait times, and overall patient and staff satisfaction. This final report presents the methods, conclusions, and final recommendations of the project.

**Background**

The Transplant Clinic, located in the Taubman Center at the University of Michigan Hospital, is a multidisciplinary clinic that opened in 2013. The clinic specializes in nephrology, hepatology, and surgery for transplant patients as well as infectious disease, dialysis treatment, and general hepatology. Patient visits can be classified into four categories: pre-evaluation, evaluation, post-transplant check-in, or chronic illness. Patients in this clinic need a kidney or liver transplant.

The clinic operates Monday to Friday, 8:00 AM - 5:00 PM. Each day is divided into two shifts. The first shift starts at 8:00 AM and ends at 12:00 PM, and the second shift starts at 1:00 PM and ends at 5:00 PM. Patients may, however, start checking in for 8:00 AM appointments at 7:30 AM. Patients are given a 30-minute grace period before the appointment is subject to cancellation. Appointments can be scheduled up to a year in advance; however, patients typically schedule future visits via personal physicians in the clinic.
Upon arrival, the patients check in at one of three desks with a clerical staff member. The patients are prompted to complete any necessary paperwork before being escorted to an evaluation room. Depending on the patient type, the patient may see a nurse, medical assistant, and or a physician. The appointment is conducted and the patient is then escorted to the one check out desk for further scheduling. A general diagram of the patient flow is shown in Figure 1 below. Right now there is no system in place that gives real time updates of the location of patients or providers in the clinic, which is causing breakdowns in communication among staff members.

![Figure 1: Transplant Clinic General Patient Flow](image)

Once major concern for many of the Transplant Clinic staff member was that there is no standard process for allocating the number of rooms to physicians. This is contributing to the poor room utilization by assigning providers either too many or too few rooms for the number of patients they are expecting to see during a given shift. Referencing Appendix A, the current schedule has providers assigned with two rooms seeing anywhere from two to ten patients. In certain cases, such as evaluation cases, each patients needs one room; however, for long term clinics there should needs to be a standardized room allocation process that assures rooms are utilized at all times.

The clinical staff also collected data on the number of patients seen each day in the clinic, the number of rooms being utilized, the number of rooms empty during clinic hours, and the number of providers necessary to meet the demand for each day of operation. The staff reported that Tuesday through Thursday the clinic is typically overbooked, behind schedule, and overall chaotic. For example, during the week of February 2, 2015, 138 patients were seen on Wednesday. Where as on Friday, only 98 patients were seen in the clinic for the entire day (See Figure 2). Providers, in particular, expressed concern with the unpredictable patient flow and how the variability forces most of them to work beyond scheduled clinic hours to finish seeing patients.
In general, patients who have appointments on Tuesday, Wednesday, or Thursday often experience long wait times and the clinic experiences difficulty with managing the number of rooms available in relation to the number of patients in the clinic. On Friday PM shifts, there is a surplus of room availability and many employees are under utilized. In particular, the liver transplant staff has expressed concern about the number of rooms available in the morning to ensure a favorable workflow. Patients being initially evaluated for a transplant pose a unique problem, especially for liver patients, because these visits tend to last longer and cause patient bottlenecks.

Therefore, the research translation specialist tasked the team with developing a new schedule that will allow for the variability in patient visits and reflect real time availability in the clinic, decrease patient wait times, and increase room utilization, improving the patient experience.

**Key Issues**

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

- Patients are dissatisfied with wait times
  - Some patients have waited over 60 minutes to be seen by a physician
- Staff is displeased with the unpredictable patient flow
- Certain days/times of the week tend to be overbooked, which leads to long patient wait times, overwhelmed staff, and a chaotic environment
- Certain days and times of the week tend to be under booked, which results in empty rooms and underutilized resources
- Clinic serves several kinds of patients, which makes it difficult to predict the length of patient’s visit times
  - Visits can range from 20 minutes to 8 hours
  - Evaluation visit patients can occupy a room for 4 hours
- Schedule has high variability week-to-week
The 1st and 2nd Monday of the month are not consistent

Goals and Objectives

The primary goal of this project is to create two alternative schedules that will yield the highest room utilization possible and improve workflow within the Transplant Clinic’s given constraints. These improvements will, in turn, decrease process flow bottlenecks and improve the patient experience. To achieve this goal, the team will address the following objectives:

- Design a schedule that accounts for inherent patient variability
- Improve the chain of communication
- Standardize room allocation practices

Project Scope

The scope of this project includes only the schedule and workflow process in the Taubman Transplant Clinic. The team focused on ways to improve the workflow through scheduling, lean thinking, and the communication processes between staff members.

This project does not include delays due to unforeseen medical issues that disrupt the clinic workflow process (i.e. if a patient is sent to the Emergency Room or sent to other clinics). The team’s clinic schedule does not consider any other entity of the University Hospital. The clinic will be evaluated as if it were a single operating entity. Lastly, the project does not include plans to renovate the clinic area or hire more staff.

Methods and Findings

To determine where improvements can be made to the Transplant Clinic’s schedule, the team collected data during observations, shadowing, interviews, and a Gastrointestinal Clinic visit.

Observations and Shadowing

The team conducted 36 hours of observations between February 20 and March 10 in the Transplant Clinic.

Method

The team shadowed eight providers during these observations that served either kidney or liver transplant patients and followed three patients through their entire visit. The observations and shadowing confirmed the key issues the team had previously identified with the Research Translation Specialist prior to starting the project. The team saw first hand how the lack of a dynamic schedule coupled with communication breakdowns lead to disrupted workflow and long patient wait times. The team found anywhere from zero to four rooms are not being utilized on the days the clinic was overbooked and running behind schedule. The team also observed confusion among staff members over the exact location of patients within the clinic. Other than one member of the liver team, there is never one sole person in the clinic that is able to give real time locations of patients or providers.
The underutilized rooms were not the only issue the team observed with the current schedule during the observations and shadowing. The team noticed that the clinic tended to run behind when a sufficient number of rooms were not allocated for evaluation patients. Evaluation patients tended to tie up rooms for the entire or morning shifts in the clinic, often leaving providers with no other available rooms to see non-evaluation patients. For example, a physician that was scheduled to see three evaluation patients during the shift would end up running behind schedule because there would be no rooms for his or her other non-evaluation patients scheduled.

Findings

Through direct observation and shadowing of clinic staff, the team found three main issues. First, the patient evaluation rooms in the clinic are being underutilized. Even on extremely busy days, when patients are sitting in the waiting room for long times, some clinic rooms sit open. The team found that during anywhere from zero to four rooms were not being utilized during the observation period.

Secondly, the team found that there is breakdown in communication amongst the clinic staff. With physicians and nurses sitting separately from MAs, not one person in the clinic was able to give real time updates of the whereabouts for every staff member and patient in the Transplant Clinic. This led to instances where patients would be sitting in the evaluation rooms waiting to see a provider for extended periods of time because the provider was not aware the patient was ready to be seen. Poor communication among providers also resulted in medical reconciliation being performed on three separate occasions over the course of a patient’s visit. Breakdowns in communication increased patient wait times and frustrated clinical staff members.

Lastly, a key factor that led to delays in the clinic was the practice of double booking patients for one time slot. This practice leads to an insufficient number of rooms allocated for the overbooked patients and puts the entire clinic behind schedule.

Interviews

After completing clinic observations and shadowing, the team conducted three interviews to a deeper insight into the key issues identified by the Research Translation Specialist.

Method

The team interviewed three staff members of the Transplant Clinic: two providers and one manager. The interviews continued to explore the key scheduling and workflow issues faced by the Transplant Clinic, and to start brainstorming solutions for a new clinic schedule.

Findings

All three interviewees said that too many providers are scheduled Tuesday through Thursday. Several ideas were discussed that could help mitigate this unevenness in scheduling:

- Have some providers move their clinics to Friday afternoon or Monday morning
- Implement a rotating clinic schedule on Friday
• Implement a staggered patient check-in schedule
• Extend the clinic’s hours of operation

By having two to four providers move one of their clinics to either Friday afternoon or Monday morning, the clinic schedule would be better spread. Another idea proposed was to have a rotating clinic schedule on Fridays so that no one single provider always had to give up research hours or other commitments on a Friday afternoon. To combat the long checkout lines and patient variability, the team discussed implementing a staggered schedule so that patients do not all arrive at the same time. The team is also exploring the possibility of extending the clinic’s hours of operation to create another outlet to disperse patients.

During the interview process, an emphasis was placed on finding ways of creating a schedule that was dynamic and could be flexible to change in a moment’s notice to account for the natural variability in each patient’s visit time. The following possibilities were discussed:
• Assigning patients to rooms rather than physicians to rooms
• Having staff see patients in consult rooms rather than evaluation rooms
• Disallowing double booking
• Seeing only the same types of patients in each shift

The team and the interviewees discussed the possibility of assigning patients to rooms rather than assigning physicians a set number of rooms. In order for this type of schedule to be successful, the team and the providers agreed that there would need to be someone in the clinic solely responsible for overseeing all the rooms and the staff to make sure the workflow was maintained and all rooms were utilized. Staff such as research, dieticians, and social workers will need to get in the practice of seeing patients in consult rooms. There would also be no double bookings allowed to maintain the fluidity necessary to operate this dynamic schedule. Lastly, the schedule would benefit by having only the same type of patients be seen in each shift of clinic operation.

**Gastrointestinal Clinic Visit**

The Research Translation Specialist suggested observing the Gastrointestinal (GI) Clinic because the clinic is known for running efficiently and without major delays.

**Methods**

As per the recommendation of the transplant staff, the team visited the GI Clinic on March 25th. The first visible difference between the Transplant Clinic and the GI Clinic was that there was no differentiation between check-in and check-out desks. Certain procedures traditionally handled by MAs, such as asking patients about potential Ebola exposure, are handled at the check-in/check-out desks.

The clinic utilizes lean processes. Everyday the GI clinic team has a “huddle” called ELI-Everyday Lean Idea. This huddle brings all the staff members and roles together for a five-minute meeting three times a week to discuss potential new workflow ideas or issues staff members have encountered in the clinic. The huddle helps the GI clinic team make sure that all the staff is on the same page and propose potential solutions to current problems.
Room allocation in the GI clinic follows as a physician gets one room for every six to eight patients, two rooms for every ten to twelve patients, and so on. Another way that the GI clinic differs from the Transplant Clinic is that providers are not assigned specific rooms. The MA’s print out a paper with each physician’s schedule for the day. Patients are tracked with a sticker that have room numbers on them. Doctors are then able to see where their patients are at all times and what rooms are available.

The MA’s print out a paper with each physician's daily appointments and use stickers (with room numbers written on them) to identify the room the doctor will go to and use any available rooms to room patients. Once the appointment is complete and room is cleaned, the sticker returns to the “pool” of available rooms and becomes available for use by any physician.

*Findings*

The GI clinic visit introduced the team to the possibility of implementing lean processes in the Transplant Clinic. Having a “huddle” or ELI a three days a week would help the Transplant Clinic team with their current communication issues. If MAs and physicians continue not to sit in the same room, these huddles will help the Transplant team to be aware of all current problems in the clinic and potential solutions to the problems can be talked through.

Not only are the team huddles good for communication issues, but also it allows for continuous improvement in every aspect of the clinic. It allows for the voices to be heard of every employee in the clinic, rather than just the managers. This type of atmosphere in the clinic increases the morale of the clinic because every level of employee can make a difference.

Lastly, the team found that the sticker system for showing the exact location of patients in the clinic was effective in keeping all staff members up to date on the whereabouts of all the patients. By not having providers assigned to specific rooms, patients were always guaranteed to have a room for their designated time slot.

*Conclusions*

After analyzing the findings, the team developed conclusions as to why the Transplant Clinic currently has low room utilization and workflow issues.

*Room Allocation*

The team came to two conclusions about the Transplant Clinic’s room utilization. First, the practice of assigning rooms to physicians based on their rank is not effective. An attending does not necessarily see more patients in a day than a mid-level provider, so the current allocation rules are ineffective. Similarly, the practice of double booking patients is ineffective, as one provider usually cannot see two separate patients in the same appointment slot without causing delays for the remainder of the day.
Scheduling

The team found that current clinic schedule is unbalanced mainly due to physician preference. Most physicians at the Transplant Clinic prefer to hold their clinics in the middle of the week, rather than on Monday mornings or Friday afternoons. Many of the physicians’ clinic schedules are solely based on these preferences, rather than actual work commitment in other parts of the hospital. With this in mind, the team concluded that a new schedule would need to take into account physician preference, yet not consider it an unbreakable constraint.

Moreover, the lines for check in and check out can get lengthy and lead to further delays in an already tight schedule. The Transplant Clinic needs a schedule that will alleviate the mass influx of patients at popular check in and check out times such as 10 am or 1 pm.

Lastly, the team noted that the current schedule lacked adjustability because there are no flexible rooms built into the schedule. It is time consuming for the scheduler to quickly make changes because specific rooms are allocated in advance to physicians and no rooms are leftover for excess demand in the case of bottlenecks or delays.

Workflow

The team concluded that the Transplant Clinic’s lack of communication can be, in part, attributed to the lack of a simple, clear, and central patient tracking system. The transplant clinic staff currently uses software on their computers to track the status of a patient once they are checked-in. The team found that the staff is not using this system consistently. Furthermore, the team found that the system does not always update in real-time and is not very clear to use or understand. Currently, a staff member cannot look in one place and quickly see the status and/or location of all of the patients in the system. The lack of a better tracking system is contributing to the breakdown in staff communication.

Recommendations

The team came up with recommendations that the Transplant Clinic can implement in order to increase room utilization and efficiency. The team also incorporated some of these recommendations into two new weekly clinic schedules.

Room Allocation

In order to address the issues regarding room allocations, the team decided to assign rooms based on number of patient and patient type, rather than on “rank.” For example, a provider scheduled to see zero to seven patients in a shift, they would be assigned one room, seven to nine patients in a shift would result in an allocation of two rooms, and more than 13 rooms would earn a provider three rooms. The patient type should also be a factor in room allocation, as evaluation patients need a room for the entire day, yet post-op check-up patients typically only occupy a room for 30 minutes. Additionally, the team concluded that the practice of double booking patients should not be allowed at all.
Scheduling

The team has developed two alternative schedules for the Transplant Clinic to potentially adapt. The first alternative schedule is minor change, which can be found in Appendix B. The second is a more drastic change that includes a rotational schedule. It can be found in Appendix C.

Both schedules have a more balanced workload across the week so certain days are not significantly busier than others. This will help to ensure that the clinic can better utilize their resources and achieve some consistency throughout the week. The new schedules also offer additional organization and ease of use. For readability purposes, certain positions on the schedule have color-coded font. The color schemes are as followed: Doctors are labeled black, mid-level providers are blue, fellows are red, and social workers/dieticians are labeled green. The color scheme highlights each position to diffuse any confusion or disorganization during the scheduling process.

In both schedules, the team has removed the specific providers names and set up a schedule that assigns each department within in the Transplant Clinic a certain number of provider slots and rooms for any given shift. The team chose to not move specific providers due to the lack of every staff member’s personal schedule and restrictions. The details for the two alternative schedules are as follows:

Schedule 1: Minimal Changes

Looking at Appendix B, the team designed a schedule that required minimal changes to the current grid. One or two providers from each shift on Tuesday through Thursday were moved to either the morning or afternoon shift on Monday or Friday to alleviate negative room availability.

Schedule 2: Rotating Structure

The team created a rotational schedule to balance the schedule grid and encourage hosting more clinic hours on Fridays (See Appendix C). Each department within the clinic will hold visitation periods on Friday mornings and afternoons. Based upon the required number of staff members for each clinic, physicians will rotate through these shifts. The schedule will promote fairness and flexibility for the doctors to rotate through shifts. Depending on the manning, the doctors will be encouraged to work on Fridays between one to two times per month or less. For departments with more doctors, the team estimates a physician will be required to work one Friday every two to three months. This ensures that the clinic is more balanced, but also provides flexibility to each physician’s personal schedule and preferences. The rotational schedule increases the number of patients seen on Fridays. This change balances the schedule grid and reduces the patient volume during the middle of the week.

In order to accommodate physician preference, the team suggests using a rotating schedule for Friday afternoon clinics. Physicians would rather not have to work in the clinic on Friday afternoons, however it is necessary to hold clinics during that time in order to achieve a balanced workload across all shifts. With this in mind, the team proposes that the Friday afternoon is a
rotating clinic. Physicians will only be scheduled for clinic work once every Friday. This allows Friday afternoons to be just as busy as other shifts throughout the week, but does not force any one type of clinic or group of physicians to work that shift every week.

Additional Scheduling Recommendations

In addition to using one of the newly developed clinic schedules, the clinic should also follow three recommendations that will add a level of flexibility to the weekly schedule. First, the clinic should allocate rooms in such a way that leaves one to four rooms per shift available as “on-call” rooms. That way, the schedule has a built-in buffer to help manage unforeseen delays or last-minute changes. Secondly, the team has created an Excel template for scheduling that the clinic should consider using. The team utilized the conditional field function on Microsoft Excel to show the level of room availability for each shift. If the number of available rooms is positive, the field is shaded green. If the number of rooms reaches 0, the field is shaded yellow. If there are overbookings, the field is shaded red. As seen in Appendix B and Appendix C, these color indications provide a clear and simple method to monitor the number of rooms available so that the scheduler can easily visualize which days the clinic is being over or under utilized.

Lastly, in order to assure the success of either alternative schedule, the Transplant Clinic staff needs to stress the importance of using consult rooms for meetings that are not essential to have in an evaluation room. Stressing the practice of consult rooms will allow the clinic to maintain flexibility by not occupying rooms left for delays or last minute changes.

Workflow

The team developed several conclusions regarding ways to make the clinic communicate and flow better. In order to maintain clear communication and keep track of patient flow, the clinic should utilize a large whiteboard that outlines each step of a patient’s visit. By visually tracking the status of a patient from check in to check out, the staff will be able to prepare rooms and get patients in them more quickly. An example of an effective whiteboard layout can be found in Appendix D. The location of the patient is moved along the board using magnets. Furthermore, it monitors the time that the patient arrives at the evaluation room. This time stamp provides staff members a quantitative snapshot of current wait times in the clinic. The whiteboard encourages members to constantly communicate about patient statuses, room availability, and physician whereabouts. The whiteboard requires a staff member to move around the clinic, observe where patients are in the system, and communicate with others to determine patient whereabouts. This system will not only provide a more effective update on patient status, but also reduce the amount of time a patient is idle in the system.

Staff at the Transplant Clinic should also consider formalizing their communication channels by having clinic-wide meetings or “huddle” like the GI clinic does. Meetings should happen at least once a week and should have staff members from all levels and positions (MAs, Nurses, Physicians, Receptionists, etc) and also include representation from both the liver and kidney clinics. The team expects that these meetings will help to open communication between different groups in the clinic and facilitate pro-activeness among staff. These meetings will help to ensure that the clinic as a whole is actively trying to improve and continuously evaluating themselves.
Expected Impact

There are three main areas the team expects to see the new schedule and workflow improvements to impact. The first major impact will be the leveling of the number of patients seen each day. The second major impact will be the number of rooms available each shift will all be in positive. Lastly, the team expects a more formalized communication structure will help the clinic staff maintain the new schedule and keep the clinic grid running on time. Seeing as the clinic staff members expressed a desire for a rotating schedule so no one provider always had to work Friday’s or Monday’s, the team developed expected impact metrics based on alternative Schedule 2: Rotation Structure.

Number of Patients Per Shift

If the Transplant Clinic were to adapt alternative schedule 2: rotational structure, the number of patients seen each morning shift during the week will go from seeing around 130 patients on Wednesdays and 90 patients on Fridays to an average of 85 patients a day, excluding Monday mornings (See Figure 3).

![Figure 3: Number of Patients Per Shift (AM)](image)

The same analysis was done for the afternoon shifts during the week (See Figure 4). The number of patients seen in the afternoons in the new schedule would vary from 52 to 75. With the largest number of patients seen Friday afternoon because of the newly implemented rotating schedule. Where as in the old schedule the daily totals ranged from 42 to 76.
By leveling the number of patients seen each morning and afternoon shift, there will be a steady demand that the new schedule will be able to accommodate. Providers will no longer complain about not being able to anticipate the demand for the day.

**Number of Available Rooms**

The same analysis was performed above was done for the number of rooms available in the morning (AM) and afternoon (PM) shifts. Looking at Figure 5 and Figure 6, there are no longer any negative available rooms. Each shift has at least one available room.
On busy days in the current schedule, insufficient rooms are available for the number of physicians working and patients scheduled. The new schedule has one to four available rooms built into each shift. The team expects that this added flexibility will help with the unavoidable patient variability and ultimately decrease patient wait times.

Workflow

The team expects that the solutions will positively impact the workflow too. The sticker and whiteboard implementations will force employees to maintain clear lines of communication throughout. Increased communication will eliminate the idle time a patient is waiting and ensure the staff members are privy to clinic’s state. The workflow improvements will allow the clinic to operate more closely to their schedule and reduce the number of patients waiting for extended periods of time. Overall, these changes will improve the patient experience at the clinic and reduce the number of bottlenecks.

Appendices: Current Schedule, Schedule 1: Minimal Changes, Schedule 2: Rotational Structure, Whiteboard Concept
<table>
<thead>
<tr>
<th>Providers</th>
<th>Total patients roomed</th>
<th># Faculty</th>
<th>MAs needed for clinic flow</th>
<th>Total patients roomed</th>
<th># Faculty</th>
<th>MAs needed for clinic flow</th>
<th>Total patients roomed</th>
<th># Faculty</th>
<th>MAs needed for clinic flow</th>
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<td>MLP: Timmerman</td>
<td>2 8 13 60</td>
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<td>2 8 14 72</td>
<td>MLP: Licari</td>
<td>2 8 6 57</td>
<td>MLP: Licari</td>
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<td>MLP: Gajos</td>
<td>2 8 14 72</td>
<td>MLP: Licari</td>
<td>2 8 6 57</td>
<td>MLP: Timmerman (1st/4th)</td>
<td>2 8 13 86</td>
<td>MLP: Licari</td>
<td>2 6 6 57</td>
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<tr>
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<td>2 8 13 60</td>
<td>MLP: Gajos</td>
<td>2 8 14 72</td>
<td>MLP: Licari</td>
<td>2 8 6 57</td>
<td>MLP: Timmerman (1st/4th)</td>
<td>2 8 13 86</td>
<td>MLP: Licari</td>
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<td>MLP: H&amp;P</td>
<td>2 8 - -</td>
<td>MLP: H&amp;P</td>
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<td>Endocrine</td>
<td>3 6 0</td>
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<td>Endocrine</td>
<td>3 6 0</td>
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<td>General Surgery FU doc</td>
<td>1 1</td>
<td>General Surgery FU doc</td>
<td>1 1</td>
<td>General Surgery FU doc</td>
<td>1 1</td>
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**Note:** The above table provides a summary of patient rooming and faculty assignments for different specialties on various days of the week. The table includes columns for total patients roomed, faculty members, and the number of medical assistants needed for clinic flow. The data is organized by specialty and day, with specific details for each category.
<table>
<thead>
<tr>
<th>DAY</th>
<th>Time</th>
<th>Providers</th>
<th>Room Time</th>
<th>Waiting Room</th>
<th>Appt Time</th>
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<tbody>
<tr>
<td>MONDAY</td>
<td>1:00-5:00PM</td>
<td>Physician H1 - H4</td>
<td>1</td>
<td>2 8 11 79</td>
<td>MAs needed for clinic flow</td>
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<td>TUESDAY</td>
<td>1:00-5:00PM</td>
<td>Physician H7</td>
<td>1</td>
<td>2 8 12 100</td>
<td>Surgery FU doc</td>
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<td>1:00-5:00PM</td>
<td>Physician L7/L8 (switch off)</td>
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<td>2 8 29 170</td>
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<td>THURSDAY</td>
<td>1:00-5:00PM</td>
<td>Physician L1</td>
<td>1</td>
<td>2 8 13 60</td>
<td>MAs needed for clinic flow</td>
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</tbody>
</table>

**Hepatology**

- **Liver Acute**
  - Physician H1: July 2015
  - Physician K2: July 2015
  - Physician K4: July 2015

- **Liver-Scrub**
  - Physician H3: July 2015
  - Physician H5: July 2015

**General Surgery**

- Physician H6: July 2015
  - Physician K17: July 2015
  - Physician K19: July 2015

**Endocrine**

- Physician L2: July 2015
  - Physician L3: July 2015
  - Physician L4/L5: July 2015
  - Physician L13: July 2015
### Appendix C - Schedule 2: Rotational Structure

<table>
<thead>
<tr>
<th>Day</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
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<tbody>
<tr>
<td>Time</td>
<td>8 AM - 5 PM</td>
<td>8 AM - 5 PM</td>
<td>8 AM - 5 PM</td>
<td>8 AM - 5 PM</td>
<td>8 AM - 5 PM</td>
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<tr>
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<td>Physician KJ</td>
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<td>Total Patients Roomed</td>
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<tr>
<td>Total Patients Roomed</td>
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<td>100</td>
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<td>100</td>
<td>100</td>
</tr>
<tr>
<td>MAs Needed for Clinic Flow</td>
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</tbody>
</table>

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<th>Thursday</th>
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<td>8 AM - 5 PM</td>
<td>8 AM - 5 PM</td>
</tr>
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</tr>
</tbody>
</table>
Whiteboard/Clinic Workflow Coordinator: Role & Description

The following information is an initial implementation plan for the whiteboard/coordinator process that Group 4 recommends to incorporate at the Taubman Transplant Clinic.

**Purpose:**
- improve the workflow within the clinic.
- improve communication between staff members
- reduce the wait times for patients.
- standardized clinic communication and workflow process.

Below is an example of a virtual document, whiteboard, or application that can be used. Our group assumes that this board will be updated as close to real time as possible.

<table>
<thead>
<tr>
<th>Patient Name</th>
<th>Checked In</th>
<th>With Nurse/MA</th>
<th>Ready for Physician</th>
<th>Time in eval-room</th>
<th>Physician is with Patient</th>
<th>Consult Room</th>
<th>Elsewhere in hospital</th>
<th>Checked Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example Below</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Jane Doe</td>
<td>1:45 PM</td>
<td>-</td>
<td>●</td>
<td>2:00 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mike Smith</td>
<td>2:15 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>John Legend</td>
<td>3:00 PM</td>
<td>3:20 PM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Elsewhere in hospital</td>
<td>4:00 PM</td>
</tr>
</tbody>
</table>

**White board:** use magnets to move along board as patient progresses through their visit.

**Electronic document or application:** same concept can be used for real time updates. Physicians, MAs, etc. will have viewing access via online document or through MiChart.

**Clinic Workflow Coordinator:** Member of staff that will roam clinic, communicate with staff members, and update status board as frequently as possible. Other roles could be and are not limited to:
- Notifying physicians of patient status and room status
- Encouraging positive communication between staff members
- Motivating staff members to work at a high level of efficiency
- Having a good understanding of current clinic state throughout shift