Neurosurgery Clinic Analysis:
Increasing Patient Throughput and Enhancing Patient Experience

Final Report

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Table of Contents

Executive Summary ........................................................................................................ 5
Background ..................................................................................................................... 5
Goals and Intermediary Objectives ............................................................................. 5
Approach ....................................................................................................................... 6
  Data Collection .......................................................................................................... 6
  Data Analysis .............................................................................................................. 6
Findings ........................................................................................................................... 7
Conclusions .................................................................................................................. 7
Recommendations ......................................................................................................... 8
Expected Outcomes ...................................................................................................... 8
Introduction .................................................................................................................. 9
Background .................................................................................................................. 9
Goals and Intermediary Objectives ............................................................................. 10
Project Scope ............................................................................................................... 11
Expected Outcomes ..................................................................................................... 11
Approach ....................................................................................................................... 11
Data Collection ........................................................................................................... 12
Data Analysis ............................................................................................................... 12
Recommendations ........................................................................................................ 13
Physician Survey ........................................................................................................ 13
Room Utilization .......................................................................................................... 14
Findings ......................................................................................................................... 14
Conclusions .................................................................................................................. 16
Recommendations ........................................................................................................ 16
Distribution of Patient Time in Exam Rooms .............................................................. 16
Findings ......................................................................................................................... 16
Conclusions .................................................................................................................. 19
Recommendations ........................................................................................................ 19
Physician Activity ........................................................................................................ 19
Findings ......................................................................................................................... 20
Conclusions .................................................................................................................. 22
Recommendations ........................................................................................................ 22
Summary ....................................................................................................................... 24
Conclusions .................................................................................................................. 24
Recommendations ........................................................................................................ 24
Expected Outcomes .................................................................................................... 25
Appendix A – Patient Flow Chart .............................................................................. 26
Appendix B – Patient Log Sheet ................................................................................ 27
Appendix C – Exam Room Log Sheet ......................................................................... 28
Appendix D – Physician Survey ................................................................................ 29
Appendix E – Patient Arrival Distribution (Compared with Scheduled Appointment Time) ................................................................................................................. 31
Appendix F – Physician Survey Results................................................................. 32
Appendix G – Average Visit Duration................................................................. 33
List of Tables and Figures
Table 1 - Relative Frequency by Patient Type (Physician Activity: With Other Patient). 22
Table 2 - Relative Frequency by Patient Type (Physician Activity: Other). 22
Table 3 - Relative Frequency by Patient Type (Physician Activity: At Computer). 23
Table 4 - Relative Frequency by Patient Type (Physician Activity: Out of Clinic for Unknown Reason). 23
Table 5 - Relative Frequency by Patient Type (Physician Activity: Physician Not Arrived At Clinic). 23
Table 6 - Average Patient Wait Time (Physician Not Arrived To Clinic). 23

Figure 1 - Perceived Allocation of Physician Activity. 14
Figure 2 - Average Daily Utilization by Room. 15
Figure 3 - Average Daily Room Utilization by Day of Week. 15
Figure 4 - Average Time Distributions for New Patients. 17
Figure 5 - Average Time Distributions for Post-Op Patients. 18
Figure 6 - Average Time Distributions for Return Patients. 18
Figure 7 – Reason for Wait: New Patient. 20
Figure 8 – Reason for Wait: Return Visit Patient. 21
Figure 9 – Reason for Wait: Post-Op Patient. 21
Executive Summary
Since 2003, the Neurosurgery Department at the University of Michigan Health Service System has experienced continuous growth in its number of clinic visits. The neurosurgical business in the state of Michigan is, and will continue to be, highly competitive because six area hospitals (within four separate health systems) are ranked in the Top 49 Neurosurgery & Neurology Hospitals in the United States (according to U.S. News and World Report, July 2007) and all are within 50 miles of another ranked hospital. To accommodate the increase in current patients or the prospective increase in new patients, the Program & Operations Analysis team was asked to observe daily clinic operations, collect data on the current scheduling and patient throughput systems, and provide results and recommendations to improve efficiency in the clinic, with the ultimate goal of increasing the number of patient clinic visits, primarily in new patient visits.

Background
The Pediatric and Adult Neurosurgery Clinic (“the clinic”) is located on the 2nd floor of the Taubman Center in Reception G. The Neurosurgery Department (“the department”) administrative offices are located directly above the clinic on the third floor. Twelve physicians staff three teams, along with 14 residents at different stages of residency. The physicians use 8 to 12 exam rooms from 8am to 5pm Monday to Friday. Primarily, four types of visits exist: H&Ps (history and physicals), new patients, return visits, and post-op visits.

Based on the team’s preliminary discussions with clinic employees, the general opinion of the administrators, nurses, secretaries, and physicians is that many areas of inconsistency and inefficiency exist within the daily clinic activities. Administration feels that the secretary’s scheduling is inconsistent. Administration also feels that staff is underutilized, and limited guidelines are in place for room assignments, all of which cause increased patient wait times both in and out of the clinic.

Goals and Intermediary Objectives
To improve patient throughput and increase number of patient visits, the Neurosurgery Department goals are to:

- Increase clinic volume, primarily new patients, with the given space allocation
- Increase patient satisfaction by improving the process encompassing the entire patient experience
- Improve physician satisfaction with the process

To achieve these main goals, the following intermediary goals were set for the department:

- Schedule patient appointment within 48 to 72 hours of receipt of referral
• See the new patient within two weeks of referral
• Improve percentage of on-time start of patient appointments
• Reduce patient waiting times throughout the process
• Reduce overall patient process time

Approach
The team performed the project in three phases: data collection, data analysis, and recommendations.

Data Collection
Data collection included:

• Literature search
• Interviews
• Time studies and work measurement
• Physician surveys

The team formally interviewed the two medical assistants (MAs). Along with the formal interviews, the team informally interviewed the physicians, physician extenders (nurse and/or physician assistant), administration, and other faculty involved with the clinic and department to obtain qualitative data about the clinic. The team also conducted a literature search to obtain information regarding Neurosurgery and logistics in clinics similar to that of the Neurosurgery clinic. After conducting a literature search, the team performed time studies and work measurement to determine various task times.

The time studies gathered data regarding room utilization and the breakdown of patient time spent while the patient was in the exam room. Room utilization data was gathered from February 18th to March 14th 2008. Patient data was gathered from March 3rd to March 14th 2008. The time studies and work measurements were conducted using two types of log sheets filled out by the clinic staff and team members. Clinic staff used the exam room log sheets to collect daily room usage data during clinic operation hours. Team members used the patient log sheets during clinic operation hours to collect qualitative and quantitative data. Using the patient log sheets, detailed information was gathered regarding reasons for wait and specific observations that the team made (Appendix B – Patient Log Sheet and Appendix C – Exam Room Log Sheet).

Data Analysis
During data analysis the team produced flowcharts of patient flow throughout the system to identify value and non-value added work (Appendix A – Patient Flow Chart). Using the flowchart to determine the typical components of a patient visit, and data obtained from the log sheets, the team calculated the average time a patient spent with a medical service provider, the average time a patient spent waiting in the exam room, and the average times for the reasons that a patient waited in the exam room. The log sheets also provided insight into bottlenecks in the current process. Along with analyzing data
gathered from the log sheets, the team compiled information gathered from interviews and physician surveys to explore possible areas for improvement.

**Findings**

After analyzing the data, the team developed the following findings:

- Average daily room utilization was 31%.
- Patient time spent with the physician and other service providers depends on the type of appointment.
- Patient appointment duration depended on the service model being used (i.e. physician works alone or physician has a physician extender).
- Significant average wait times: 16 minutes (35%) when alone and 27 minutes (44%) when working with a physician extender.
- High standard deviation for length of appointment (13 to 42 minutes), meaning overall appointment length would usually fall between 30 to 90 minutes.
- Service provider is with patient < 50% of the time the patient is in the exam room.
- Physician utilizing a physician extender reduces physician time spent with patient by half (~25% of total patient time in exam room).
- Most significant reasons for wait, regardless of patient type are listed in order of significance:
  1. Physician is providing service for another patient.
  2. Other (includes waiting for other service provider, or any other activity not categorized or unknown to logger).
  3. Physician is at their computer (could be loading studies, using e-mail, reviewing MRIs, reviewing CT Scans, etc.).
  4. Physician has stepped out of clinic for an unknown reason.
  5. Physician has not yet arrived to clinic.

**Conclusions**

Based on the findings, the team developed the following conclusions:

- Room utilization varies by day of week and room number.
- Room availability does not prohibit an increase in clinic volume.
- Exam rooms are being used as a second waiting room.
- Patients spend on average between 16 to 30 minutes (40-50%) of the time in the exam room with no service provider present.
- Physician can potentially see more patients when utilizing a physician extender.
- Clinic is scheduling close to capacity using current patient care process.
- Patient type affects the “reason for wait.”
**Recommendations**
In the final phase, recommendations, the team compiled all the qualitative and quantitative information to develop recommendations to increase clinic volume, primarily with new patients, with the given space, increase patient satisfaction, and improve physician satisfaction.

The team suggests the following six key recommendations, each contributing to the overall goal of the department:

- Physicians using a physician extender should be assigned two exam rooms while conducting normal clinic, with an overflow exam room available to all physicians during the day
- Exam room scheduling should be distributed evenly by room and day of week
- Physicians should utilize a physician extender during clinic
  - Reduces amount of time physician needs to spend in room
  - Enhances physician extender’s experience and knowledge in clinic activities
- Patient scheduling should be adjusted to utilize medical service providers efficiently
- Delayed clinic starts should be avoided if possible
  - Schedule first appointment later for physicians performing their rounds
- Patient studies should be preloaded on physicians computers
  - Studies should be sent to clinic prior to visit if patient’s studies are not currently loaded in system
  - Patient studies for the day should be loaded on physician’s computer the day before the scheduled appointment

**Expected Outcomes**
The team’s recommendations will result in:

- Decreased patient waiting time in exam rooms and scheduled appointments
- Improved on-time start of patient appointments
- Decreased new patient initial wait time to two weeks from referral
- Decreased scheduling of new patient appointments to within 48 to 72 hours of receipt of referral
- Increased patient and physician satisfaction
Introduction
Since 2003, the Neurosurgery Department at the University of Michigan Health Service System has experienced continuous growth in its number of clinic visits. The increase in clinic activity is primarily a result of an increase in the number of clinical physician within the department (essentially three times the number from five years ago). Yet, the clinic still operates nearly the same as it did prior to the influx of clinical physician. The number of exam rooms and administrative support has essentially remained the same. However, the number of clinical support staff (i.e. nurse practitioners) has increased relative to the increase in clinical physician.

The neurosurgical business in the state of Michigan is, and will continue to be, highly competitive because six area hospitals (within four separate health systems) are ranked in the Top 49 Neurosurgery & Neurology Hospitals in the United States (according to U.S. News and World Report, July 2007) and all are within 50 miles of another ranked hospital. To not only remain competitive, but also ensure recognition as the premier neurosurgical service in the region, the department must continually increase its volume of new patients.

The neurosurgical service for seeing new patients is a referral-based system. The department has identified an automated web-based application that they will implement to simplify the management of referrals. Although an automated referral management system will significantly improve the department’s currently inefficient procedure for the in-take of new patients, it cannot alone increase the number of new patients seen in the neurosurgery clinic. Therefore, patient scheduling and throughput must work in synergy and at maximum efficiency.

Given the highly competitive nature of the neurosurgical field and the growth of the Neurosurgery Department at the University of Michigan, the Program & Operations Analysis team was asked to observe daily clinic operations, collect data on the current scheduling and patient throughput systems, and provide results and recommendations to improve efficiency in the clinic, with the ultimate goal of increasing the number of patient clinic visits, primarily in new patient visits. The clinic today cannot comfortably accommodate the increase in current patients or the prospective increase in new patients. Therefore, the team is studying the current situation through observation, work study measurement, time studies and surveys to develop a plan to improve patient throughput while improving (or at a minimum, preserving) both patient and physician satisfaction.

This report will describe the current problem and present recommendations to improve the scheduling and throughput system to allow for continued growth of the clinic, especially in new patient visits, and make the patient experience more efficient.

Background
The Pediatric and Adult Neurosurgery Clinic ("the clinic") is located on the 2nd floor of the Taubman Center in Reception G. The Neurosurgery Department ("the department")
administrative offices are located directly above on the third floor. Two teams of neurosurgeons staff the adult clinic: the PEET and KAHN teams, each team spending two scheduled days in the University Hospital Operating Room (OR) each week and alternating the fifth day (Fridays) each week. The two adult teams also spend two days in the clinic, and alternate the fifth day (Fridays) each week. In general, the other team has the opposite assignment of days in the clinic and OR. The third team to staff the clinic is comprised of the pediatric team. They utilize the clinic Monday through Friday and perform surgeries in the Mott Hospital ORs. However, due to emergency situations in the operating room, physician members do not always utilize their scheduled clinic time.

Twelve physicians staff the three teams, along with 14 residents at different stages of residency. The physicians use 8 to 12 exam rooms from 8am to 5pm each day that they are in the clinic. Two Medical Assistants (MAs), along with several nurses, Physician’s Assistants (PA) and other physician extenders aid in patient care during exams. Also, 7 to 8 secretaries schedule the clinic time for 1 or 2 physicians each.

The Program & Operations Analysis team focused on the manner in which the clinic operates. Typically, the clinic operates as follows: the patient enters the clinic, checks in at the reception desk, fills out administrative paperwork, and waits in the waiting room. The MA escorts the patient into the exam room and performs the initial part of the exam. The MA leaves and the patient is usually left alone until the physician and/or the physician extender (nurse/PA) arrives to finish the exam. The patient checks out at the desk and pays co-pay, if applicable. The patient is also informed of any further testing or appointments that should be scheduled; however, no additional clinic appointment is scheduled at that time.

Primarily, four types of visits exist: H&Ps (history and physicals), new patients, return visits, and post-op return visits. The appointments for the clinic range from being, in urgent instances, scheduled the next day to being scheduled in about 6 to 8 weeks dependent upon patient diagnosis, clinic availability, and physician availability. With the many secretaries and physicians who staff the clinic, different scheduling strategies and work processes exist. Based on the team’s preliminary discussions with clinic employees, the general opinion of the administrators, nurses, secretaries, and physicians is that many areas of inconsistency and inefficiency exist within the daily clinic activities. Administration feels that the secretary’s scheduling is inconsistent. They also feel that staff is underutilized, and limited guidelines are in place for room assignments, all of which cause increased patient wait times both in and out of the clinic. A better process for patient throughput and scheduling will greatly increase clinic visit volume while improving overall physician and patient satisfaction.

**Goals and Intermediary Objectives**

Neurosurgery management identified the clinic’s operational goals that will allow them to be not only a competitive choice, but also the provider of choice within their primary market. The main goals are:
• Increase clinic volume, primarily new patients, with the given space allocation
• Increase patient satisfaction by improving the process encompassing the entire patient experience
• Improve physician satisfaction with the process

Through these goals, the department also hopes to realize more revenue due to the increased volume, and improved patient satisfaction from the decrease in patient wait time for scheduled appointments and during the clinic visit. To achieve these main goals, the following intermediary goals were set for the department:

• Schedule patient appointment within 48 to 72 hours of receipt of referral
• See the new patient within two weeks of referral
• Improve percentage of on-time start of patient appointments
• Reduce patient waiting times throughout the process
• Reduce overall patient process time

**Project Scope**

This project was limited to the Pediatric and Adult Neurosurgery Clinic located on the 2nd floor of the Taubman Center, Reception G. The project focused specifically on patient flow from check in to check out. The project also examined the scheduling portion of the patient clinic visit process included in Reception G. The project only analyzed administrative processes associated with clinic scheduling and patient throughput.

The project did not include the referral management system or any other department outside of Reception G in the Taubman Center. The project did not include any inpatient services or activities associated with the actual caretaking of the patients. The project did not examine scheduling of or the actual OR process itself.

**Expected Outcomes**

Through careful analysis of the data collected using this approach, the team is providing recommendations to improve patient throughput and increase number of patient visits. The team’s recommendations will result in:

• Decreased patient waiting time in exam rooms and scheduled appointments
• Improved on-time start of patient appointments
• Decreased new patient initial wait time to two weeks from referral
• Decreased scheduling of new patient appointments to within 48 to 72 hours of receipt of referral
• Increased patient and physician satisfaction

**Approach**

The team performed the project in three phases: data collection, data analysis, and recommendations.
**Data Collection**

During the first phase, data collection, the team formally interviewed the two MA’s. Along with the formal interviews, the team informally interviewed the physicians, nurse practitioners, administration, and other faculty involved with the clinic and department to obtain qualitative data about the clinic. The team also conducted a literature search to obtain information regarding Neurosurgery and logistics in clinics similar to that of the Neurosurgery clinic. The literature search involved reviewing studies conducted on similar clinics to gain an understanding of typical problems encountered in clinics, as well as solutions that were suggested.

After conducting a literature search, the team performed time studies and work measurement to determine various task times. The time studies gathered data regarding room utilization and the breakdown of patient time spent while they were in the exam room. Room utilization data was gathered from February 18th to March 14th 2008. Patient data was gathered from March 3rd to March 14th 2008. The time studies and work measurements were conducted primarily using log sheets filled out by the clinic staff and team members. The team, using information gathered from observations, interviews, and management and staff input, developed two types of log sheets. Clinic staff used the exam room log sheets to collect daily room usage data during clinic operation hours. Team members used the patient log sheets during clinic operation hours to collect qualitative and quantitative data. The log sheets provided the team with daily room utilization along with how a patient spent their time in an exam room. The time spent in an exam room was broken up into the following:

- Patient is with a service provider (Physician, MA, PA, Nurse, and/or HO)
- Patient is waiting in exam room with no service provider

Using the patient log sheets, detailed information, such as reasons for wait and specific observations that the team made, were gathered and further analyzed (Appendix B – Patient Log Sheet and Appendix C – Exam Room Log Sheet).

**Data Analysis**

During the second phase of the project, data analysis, the team produced flowcharts of patient flow throughout the system to identify value and non-value added work (Appendix A – Patient Flow Chart). Using the flowchart to determine the typical components of a patient visit, and data obtained from the log sheets, the team calculated the average time a patient spent with a medical service provider, the average time a patient spent waiting in the exam room, and the average times for the reasons that a patient waited in the exam room. The log sheets also provided insight into bottlenecks in the current process. Along with analyzing data gathered from the log sheets, the team also compiled information gathered from interviews and physician surveys to explore possible areas for improvement.
**Recommendations**

In the final phase, recommendations, the team compiled all the qualitative and quantitative information to develop recommendations to increase clinic volume, primarily with new patients, with the given space, increase patient satisfaction, and improve physician satisfaction.

After analyzing the data, the team developed findings, conclusions, and recommendations pertaining to three areas of interest:

- Room Utilization
- Distribution of Patient Time in Exam Rooms
- Physician Activity Outside of Exam Room

These topics are discussed in detail in the following sections.

Along with these findings, the team analyzed data regarding patient arrival times with regards to scheduled times (Appendix E – Patient Arrival Distribution (Compared with Scheduled Appointment Time)) and physician survey results. Physician survey results are discussed in the following section.

**Physician Survey**

The team, with the help of the department, developed a survey for the physicians to complete. The physician survey allowed the team to gauge what the perceptions of the physicians are regarding daily clinic operations. Based on the results obtained from the physician survey, the following were the top perceived changes that would help increase physician satisfaction and/or efficiency in clinic:

- Physician extenders to provide additional assistance during clinic
- Radiologic studies loaded and/or hung in advance by staff
- Additional exam rooms
- Additional and/or improved assistance with paperwork

The physician survey results are shown in Appendix D – Physician Survey. Included in the physician survey were questions regarding the percentage of time the physicians spent on various tasks outside the exam room. Figure 1 shows the percentage of time the physicians perceive they spend on activities outside the exam room.
The team examined room utilization information from the exam room log sheets that were completed by the clinic staff (mainly MAs and nurses). The following summarizes the quantitative data that was gathered.

**Findings**

The data collected from 12 exam rooms shows that average daily room utilization was 31%. Further analysis using patient wait times in rooms showed that patients are usually waiting alone anywhere from 34% to 60% of the time in the room. This means that the service provider only utilizes the exam room 10% to 19% daily.

The analysis also showed that certain rooms are used more than others, as shown in Figure 2.
At the same time, the room usage depended on the clinic day, as shown in Figure 3.
Conclusions
The findings clearly show that all rooms are currently not being used to capacity: therefore, no additional rooms are needed. At the same time, Mondays and Thursdays have the greatest room utilization, while Friday has the lowest level.

Recommendations
The team recommends that with the current staff level and process, the current room allocation is adequate. Since the rooms are being used for patient waiting, an increase in the number of rooms will only increase the number of patients waiting in the clinic but will not increase the number served. With an increase in wait times throughout the clinic, neither patient throughput nor patient satisfaction will increase.

After reviewing the findings and the conclusions, a more uniform distribution by day would prove more beneficial as the work level becomes standard and support staff (MAs/nurses/PAs) would not have to readjust their work style depending on the day.

Distribution of Patient Time in Exam Rooms
The following summarizes data from the patient log sheets pertaining to both service times with a medical service provider and the patients wait time in the exam room. A summary of the service times for each type of patient is displayed in Appendix G – Average Visit Duration.

Findings
The amount of time spent with the physician and other service providers depends on the type of appointment. Therefore, each appointment type was analyzed for how much time the patient spent with a service provider (Physician, Physician Extender, or MA) compared to how long the patient remained in the exam room. The data also showed a difference in the length of the patient appointments depending on the service model being used (i.e. physician works alone or physician has a physician extender). Splitting the two service models for patient type gave a breakdown of how a patient spends their time in the exam room. Figures 3, 4, and 5 show a stacked bar chart of how long each service provider is in the exam room and how long the average appointment lasts depending on the service model.
As Figure 4 shows, the physician spends a significant amount of time with a new patient, which sets the University of Michigan Neurosurgery Department apart from other institutions. However, there are some problems with the current system employed by both physicians working alone and with a physician extender.

- Significant average wait times: 16 minutes (35%) when alone and 27 minutes (44%) when working with a physician extender
- High standard deviation for length of appointment (13 to 42 minutes) meaning overall appointment length would usually fall between 30 to 90 minutes
- Service provider is with patient < 50% of the time the patient is in the exam room
- Physician utilizing a physician extender reduces physician time spent with patient by half (~25% of total patient time in exam room)

Figure 5 and 6 show the average distribution of times spent with a return visit and post-op patient. While the waiting times for a new patient and a return visit seen only by a physician are within 2 minutes of each other, the post-op patients are waiting an average of 10 minutes longer. The patients being seen by both a physician and a physician extender are within a 5 minute range, but the range for wait times is at least 5 to 10 minutes longer than patients seeing only a physician.
Figure 5 - Average Time Distributions for Post-Op Patients

Figure 6 - Average Time Distributions for Return Patients
Conclusions

Regardless of which service model is used, the patient spends between 16 to 30 minutes (40-50%) of the time in the exam room with no service provider present. The time spent in the room by the physician, specifically, is cut significantly (~50%) when they utilize a physician extender, however, this is not increasing patient throughput. Both the physician and physician extender must see the patient for a combined time as if a physician was working alone. However, the problem arises when the patient must wait the time between the physician’s and the physician extender’s time in the exam room. The current scheduling process builds in this delay as evident by the length of time in the room being as much as 30 minutes longer than the average service provider spends with a patient.

With this method of scheduling the clinic is seeing the maximum patients a day and cannot schedule new patients until an existing patient is removed from the system. However, the breakdown of the time a patient spends in the exam room shows that when the waiting time in the exam room is reduced the patient can still spend the time with the service provider that is necessary, have some required waiting time and still leave 10 to 15 minutes earlier which will end up saving hours during a single day. Those hours can be used to schedule new patients. How the team determined that the wait time can be reduced will be described later.

Recommendations

Based on the findings and conclusions, the scheduled appointment blocks for each patient should be changed to better reflect the time the service providers spend in the room with a patient so as to identify the waiting time in the exam room. This means that the physician and physician extender would review the patient’s studies after the patient had arrived at clinic but prior to being placed in the exam room by the MA. The patient would then see either a physician or physician extender shortly after being placed in the exam room and examined by the MA. After the physician or physician extender finishes with the initial part of the visit, then the opposite service provider would enter immediately to complete the exam.

A deeper study of both physician and physician extender activities during clinic is also recommended. This will be easier as the physician extenders have been given defined roles in clinic. The one physician extender to one physician set up allows a splitting of total time in a patient’s room. This will allow the opposite service provider to attend to another patient or prepare for the next one. The scheduling of a physician’s day should be done with careful attention paid to which appointment types can be scheduled when.

Physician Activity

When a physician ran their assigned clinic day, the team logged the physician’s specific activity for the duration during which their patient was idle in the exam room with no service provider. To categorize the physician’s activity, the team, with the help of the department, developed letter codes for each activity. In instances that a specific activity was not captured by one of the reference letter codes, the team noted the activity or “reason for wait” to the best of their ability. For instance, if a physician was in the staff
room on their computer and the team was unable to determine the exact activity, the “reason for wait” may have been logged under a separate category.

**Findings**
The original list of activity codes (Appendix B – Patient Log Sheet) included 15 categories developed by the Neurosurgery Department staff, with the help of a physician. It was found that 2 of the top 3 reasons for patient waiting time were not included in the original 15 categories. This can mean 3 things. First, the categories were overlooked. Second, it is difficult to define the physician’s activities by watching. Lastly, the activity of the physicians in the clinic is very dynamic, and cannot be captured in 15 categories.

Figures 7, 8, and 9 show, in descending order, the reason a certain type of patient waited to receive service from a service provider. The data below was captured by the patient log sheet and was logged by the team.
Figure 8 – Reason for Wait: Return Visit Patient

Figure 9 – Reason for Wait: Post-Op Patient
This analysis indicates the most significant reasons for wait, regardless of patient type, are listed in order of significance:

1. Physician is providing service for another patient
2. Other (includes waiting for other service provider, or any other activity not categorized or unknown to logger)
3. Physician is at their computer (Could be loading studies, using e-mail, reviewing MRIs, reviewing CT Scans, etc.)
4. Physician has stepped out of clinic for an unknown reason
5. Physician has not yet arrived to clinic

Conclusions

The findings of the physician’s activity during patient wait time show that the type of patient affects the “reason for wait.” Figures 7, 8, and 9 prioritize the wait times in order of significance from “With other Patient” down to least significance. The time and relative frequency of the physician tending to another patient can be seen in Table 1.

Table 1 - Relative Frequency by Patient Type (Physician Activity: With Other Patient)

<table>
<thead>
<tr>
<th>Type</th>
<th>Average (Hrs:Min)</th>
<th>% of Total Wait</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Patient</td>
<td>0:06</td>
<td>26%</td>
</tr>
<tr>
<td>Return Visit</td>
<td>0:08</td>
<td>31%</td>
</tr>
<tr>
<td>Post-Op</td>
<td>0:09</td>
<td>44%</td>
</tr>
</tbody>
</table>

Table 1 shows patients wait 26% to 44% of the time in their exam rooms because their physician is performing a service for another patient. This wait time shows that the exam rooms are being used as a second waiting room.

Table 2 - Relative Frequency by Patient Type (Physician Activity: Other)

<table>
<thead>
<tr>
<th>Type</th>
<th>Average (Hrs:Min)</th>
<th>% of Total Wait</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Patient</td>
<td>0:06</td>
<td>26%</td>
</tr>
<tr>
<td>Return Visit</td>
<td>0:06</td>
<td>23%</td>
</tr>
<tr>
<td>Post-Op</td>
<td>0:04</td>
<td>20%</td>
</tr>
</tbody>
</table>

Table 2 shows patients wait 20% to 26% of the time in their rooms for a reason that was not captured by the patient log sheet. This wait time shows the dynamic environment of the clinic or that the patient is waiting for a different service provider than the physician.
Table 3 - Relative Frequency by Patient Type (Physician Activity: At Computer)

<table>
<thead>
<tr>
<th>Type</th>
<th>Average (Hrs:Min)</th>
<th>% of Total Wait</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Patient (n=41)</td>
<td>0:04</td>
<td>19%</td>
</tr>
<tr>
<td>Return Visit (n=83)</td>
<td>0:05</td>
<td>20%</td>
</tr>
<tr>
<td>Post-Op (n=27)</td>
<td>0:03</td>
<td>17%</td>
</tr>
</tbody>
</table>

Table 3 shows that patients wait 17% to 20% of the time in their rooms because the Physician is at their computer. The Physician may be loading studies, reading and/or sending e-mails, reviewing studies, looking at MRIs or CT Scans, etc. The Physician was defined as “at computer” when the team could not determine exactly what the Physician was doing at their computer. The time spent at the computer can potentially be reduced.

Table 4 - Relative Frequency by Patient Type (Physician Activity: Out of Clinic for Unknown Reason)

<table>
<thead>
<tr>
<th>Type</th>
<th>Average (Hrs:Min)</th>
<th>% of Total Wait</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Patient (n=41)</td>
<td>&lt;0:01</td>
<td>3%</td>
</tr>
<tr>
<td>Return Visit (n=83)</td>
<td>0:03</td>
<td>12%</td>
</tr>
<tr>
<td>Post-Op (n=27)</td>
<td>&lt;0:01</td>
<td>2%</td>
</tr>
</tbody>
</table>

Table 4 shows that patients wait 3% to 12% of the time in their rooms because the Physician has stepped out of clinic for an unknown reason (to the knowledge of the team). This further proves the dynamic environment of the clinic, but also shows significant non-value added work if a Physician is out of clinic while a patient is waiting in a room.

Table 5 - Relative Frequency by Patient Type (Physician Activity: Physician Not Arrived At Clinic)

<table>
<thead>
<tr>
<th>Type</th>
<th>Average (Hrs:Min)</th>
<th>% of Total Wait</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Patient (n=41)</td>
<td>&lt;0:01</td>
<td>4%</td>
</tr>
<tr>
<td>Return Visit (n=83)</td>
<td>0:01</td>
<td>4%</td>
</tr>
<tr>
<td>Post-Op (n=27)</td>
<td>0:01</td>
<td>8%</td>
</tr>
</tbody>
</table>

Table 5 shows that patients wait 4% to 8% of the time in their rooms because the Physician has not yet arrived to clinic. Since this situation would only happen for the first patient of the day, and not for late day patients, it is necessary to take a closer look at further data.

Table 6 - Average Patient Wait Time (Physician Not Arrived To Clinic)

<table>
<thead>
<tr>
<th>Reason for Wait</th>
<th>Total Late Time</th>
<th>Mornings Logged</th>
<th># Not Yet Arrived</th>
<th>Percent Late</th>
<th>Avg per Morning (Hrs:Min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has Not Arrived to Clinic</td>
<td>2:58</td>
<td>12</td>
<td>10</td>
<td>83%</td>
<td>0:14</td>
</tr>
</tbody>
</table>
Table 6 shows that of the 12 mornings the team logged, the physician being logged was late 10 of those times for an average of 14 minutes per morning logged.

**Recommendations**

Based on the conclusions from the patient wait times, the team suggests specific recommendations to alleviate the patient wait times. The physician should arrive earlier to clinic in order to reduce both the late time to clinic and servicing other patient wait time. A clinic staff member should load the studies before clinic starts in order to reduce the time the physician spends at the computer. Patients should send in radiological studies prior to scheduled appointment and have studies loaded prior to clinic in order to improve physician satisfaction and decrease physician time at the computer. Lastly, further research should be done on the physician computer time, out of clinic time, and the other category that included waiting for another service provider.

**Summary**

The following briefly summarizes the main conclusions and recommendations that the team developed to increase clinic volume, increase patient satisfaction, and enhance physician satisfaction. If effectively incorporated, the recommendations will allow the clinic to increase clinic volume while utilizing existing resources efficiently.

**Conclusions**

Based on the findings, the team developed the following conclusions:

- Room utilization varies by day of week and room number
- Room availability does not prohibit an increase in clinic volume
- Patients spend on average between 16 to 30 minutes (40-50%) of the time in the exam room with no service provider present
- Exam rooms are being used as a second waiting room
- Physician spends less time (~50%) when they utilize a physician extender Clinic is scheduling close to capacity using current patient care process
- Patient appointment type affects the “reason for wait”
- Late clinic starts lead to increased patient waiting throughout the entire day

**Recommendations**

Based on these findings, the team suggests the following six key recommendations, each contributing to the overall goal of the department:

- Physicians when using a physician extender should be assigned two exam rooms while conducting normal clinic, with an overflow exam room available to all physicians during the day
- Exam room scheduling should be distributed evenly by room and day of week
- Physicians should utilize a physician extender during clinic
  - Reduces amount of time physician needs to spend in room
• Enhances physician extender’s experience and knowledge in clinic activities
• Patient scheduling should be adjusted to utilize medical service providers efficiently
• Delayed clinic starts should be avoided if possible
  o Schedule first appointment later for physicians performing their rounds
• Patient studies should be preloaded on physicians computers
  o Studies should be sent to clinic prior to visit if patient’s studies are not currently loaded in system
  o Patient studies for the day should be loaded on physician’s computer the day before the scheduled appointment

**Expected Outcomes**
If implemented correctly, these recommendations will result in:

• Decreased patient waiting time in exam rooms and scheduled appointments
• Improved on-time start of patient appointments
• Decreased new patient initial wait time to two weeks from referral
• Decreased scheduling of new patient appointments to within 48 to 72 hours of receipt of referral
• Increased patient and physician satisfaction
Appendix A – Patient Flow Chart

Patient arrives at check-in counter.

- Is patient not able to check-in?
  - Yes: Patient is sent to registration.
  - No: Does patient need any routine ancillary studies or lab work done?
    - Yes: Medical assistant takes patient to exam room and takes vitals, then leaves exam room.
    - No: What type of service? (Physician only, Physician w/ NurseP, A.H.O.)

- Patient schedules surgery appointment.
  - Yes: Does patient need surgery?
    - Yes: Patient either schedules an appointment on the spot or an appointment is scheduled at a later time.
    - No: Patient pays their co-pay (if necessary).
  - No: Does patient need to schedule another clinic appointment?
    - Yes: Patient leaves clinic.
    - No: Patient waits in room for service provider.

- Service provider enters room and performs service.

- Patient waits in exam room for Physician.

- Physician performs service, sometimes with NurseP, A.H.O. in exam room, then leaves.

- Does patient require more service?
  - Yes: Patient waits in exam room for Physician.
  - No: Patient leaves exam room and performs service, then leaves.

- NurseP, A.H.O. enters exam room and performs service, then leaves.

- Patient waits in exam room for NurseP, A.H.O.

- Physician with NurseP, A.H.O. leaves exam room and performs service.
# Appendix B – Patient Log Sheet

## Neurosurgery Clinic – Patient Tracking Sheet

*University of Michigan Health System*

**Instructions:** Fill out times using digital clock on clipboard. Enter code(s) for provider activity outside of room.

<table>
<thead>
<tr>
<th>Date:</th>
<th>Dr.</th>
<th>Patient #:</th>
<th>Patient Type:</th>
<th>Room #:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Appointment Time:**

- New Patient Visit
- Post-Op Visit
- Return Visit

<table>
<thead>
<tr>
<th>Check-In Time:</th>
<th>Check-Out Time:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**If Unable to Check-In & Sent to Registration:**

<table>
<thead>
<tr>
<th>Time Out:</th>
<th>Time In:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Sent for Routine Ancillary Studies (Labs/X-Rays):**

<table>
<thead>
<tr>
<th>Time Out:</th>
<th>Time In:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Service Provider Log

<table>
<thead>
<tr>
<th>Encounter</th>
<th>Service Provider</th>
<th>Provider Activity (codes) Outside of Exam Room</th>
<th>Time Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter Room</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Physician</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medical Assistant</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>House Officer</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nurse / Physician Assistant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Physician</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medical Assistant</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>House Officer</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nurse / Physician Assistant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Physician</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medical Assistant</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>House Officer</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nurse / Physician Assistant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Physician</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medical Assistant</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>House Officer</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nurse / Physician Assistant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Physician</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medical Assistant</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>House Officer</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nurse / Physician Assistant</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Exit Room:**

<table>
<thead>
<tr>
<th>Time Out:</th>
<th>Time In:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Comments:**

________________________________________________________________________

**Provider Activity Codes – Outside of Exam Room:**

- A – Not Arrived to Clinic
- B – Wait for Studies to be Available
- C – Look and/or Hang Radiologic Studies
- D – Review Studies
- E – Review Medical File / Record / Chart
- F – Academic Time Precepting / Teaching / Consultation
- G – Write Prescriptions / Referrals / Discharge Paperwork
- H – Write Prescriptions (Rx) using Paper Pad
- I – Write Prescriptions (Rx) using Prescription (Rx) Writer in Case Web
- J – Unscheduled Time Out of Clinic (Non-Patient Related)
- K – Dictation (Phone Notes)
- L – Phone Calls to Patients
- M – Phone Calls to Non-Patients
- N – Down Time (e.g. email, Vendors, etc.)
- O – Out of Clinic for Emergent OR
Appendix C – Exam Room Log Sheet

Neurosurgery Clinic Exam Room Log Sheet
University of Michigan Health System

Instructions: Please fill out times, to the second, using digital clock on clipboard.

Exam Room (Circle One): 1 2 3 4 5 6 7 8 9 10 11 12
Day of Week (Circle One): M Tu W Th F

Date: / / 2008

<table>
<thead>
<tr>
<th>Patient</th>
<th>Start Time</th>
<th>End Time</th>
<th>CPI #</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>:</strong><em>:</em>__</td>
<td><strong>:</strong><em>:</em>__</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td><strong>:</strong><em>:</em>__</td>
<td><strong>:</strong><em>:</em>__</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td><strong>:</strong><em>:</em>__</td>
<td><strong>:</strong><em>:</em>__</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td><strong>:</strong><em>:</em>__</td>
<td><strong>:</strong><em>:</em>__</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td><strong>:</strong><em>:</em>__</td>
<td><strong>:</strong><em>:</em>__</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td><strong>:</strong><em>:</em>__</td>
<td><strong>:</strong><em>:</em>__</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td><strong>:</strong><em>:</em>__</td>
<td><strong>:</strong><em>:</em>__</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td><strong>:</strong><em>:</em>__</td>
<td><strong>:</strong><em>:</em>__</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td><strong>:</strong><em>:</em>__</td>
<td><strong>:</strong><em>:</em>__</td>
<td></td>
</tr>
</tbody>
</table>

Comments: ________________________________________________________________

Definitions: Start Time: the time the patient first steps into the exam room.
End Time: the time the patient is done with their visit and leaves the exam room.
Appendix D – Physician Survey
Physician Survey for Neurosurgery Clinic

1. What percentage of your operative cases emanate from patients seen in your outpatient clinic?
   Circle one: 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. What percentage of your outpatient referrals are “second opinions”?
   Circle one: 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. What percentage of your time in clinic is spent loading and opening radiological studies?
   Circle one: 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. What percentage of your time in clinic is spent on paperwork (Rx, requisitions, referral to other department, etc.)?
   Circle one: 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. What percentage of your scheduled clinic time do you expect to be away from clinic for emergent operations, consults, etc.?
   Circle one: 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. What percentage of your time in clinic is spent as a preceptor for teaching (students, NPs, PAs, etc.)?
   Circle one: 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. What percentage of your time in clinic is spent on dictations?
   Circle one: 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. What percentage of your scheduled clinic time is “down time” (wait for next patient, check e-mail etc.)?
Circle one: 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. In order of priority, starting with 1 as highest, indicate what items would help improve your satisfaction and/or efficiency in clinic (place an “X” on items that you do not feel would improve your satisfaction and/or efficiency).

_____ Physician extenders (PA, NP) to handle return visits, wound checks, etc, separate from your clinic
_____ Radiologic Studies being loaded and/or hung in advance by staff (or available to do so, same-day)
_____ Designate one Exam Room as “Open” to be used for add-on clinics, emergent patients, overflow, etc.
_____ Additional Exam Rooms
_____ Additional Computers
_____ Additional Medical Assistant (MA)
_____ Additional Clinic (i.e. add ½ day clinic, extend clinic day, Saturday clinic, evening clinic)
_____ Additional and/or improved assistance with paperwork (i.e. CT reqs, lab reqs, referrals, etc.)

10. What percentage of your clinic visits come from the following: (total must equal 100%)

_____ New Patient from Internal UMHS referral
_____ New Patient from External referral within of 50 miles
_____ New Patient from External referral outside of 50 miles
_____ Return Visit
_____ Post-Op Visit

____________________________________________________________
(Print your Name Here)
Appendix E – Patient Arrival Distribution (Compared with Scheduled Appointment Time)

Distribution of Arrival Times

Source: Patient Log Sheets
March 3 - 14, 2008 (N=148)
Neurosurgery Clinic Analysis
4/2008