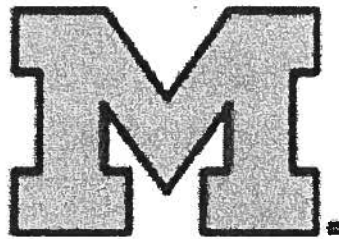


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**Assessment of Room Utilization of the Interventional Radiology Division at
the University of Michigan Hospital**

Final Report



**University of Michigan
Health Systems**

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Table of Contents

List of Tables and Figures.....	2
Executive Summary.....	3
Methods of data collection and analysis.....	3
Key Findings and Recommendations.....	3
IR Division has 14% opportunity to increase utilization.....	3
Room 6 utilization is at 48%.....	3
Time Studies.....	4
Introduction	6
Background	6
Key Issues	6
Project Goals and Objectives	7
Project Scope	7
Approach and Methodology	7
Collected Data.....	8
Observations and interviews.....	8
Utilization measures.....	8
Time studies.....	8
Historical data.....	8
Literature.....	8
Analysis of Findings.....	8
Developed Recommendations and an Action Plan.....	9
Results.....	9
Perceptions from Interviews	9
Flow Charts.....	10
Historical Data.....	11
IR Division Room Utilization.....	12
Individual IR Room Utilization.....	13
IR Utilization per Hour.....	14
Recommendations from Utilization per Hour and Utilization per Room per Shift.....	16
Implementing Recommendations.....	16
Anesthesiologist Case Findings.....	17
Fellows.....	17
Findings from Technologists Filming.....	18
IR Time Study Results.....	18
Future Analysis	27
Works Cited.....	28
Appendix A. Utilization Measures Data Collection Sheet	29
Appendix B. Time Studies Data Collection Sheet	30
Appendix C. Utilization Measures: Hours Collected.....	31

List of Tables and Figures

Executive Summary

Table 1. Summary of utilization percentages.....	4
Table 2. Key findings from time studies.....	4

Main Report

Table 1. Hours Staffed in the Interventional Radiology Division per Room.....	6
Figure 1. Room Turnover in the IR division.....	10
Figure 2. Patient Flow.....	11
Figure 3. Visceral Statistics for Patient Volumes of IR Division.....	11
Figure 4. Room State Percentages.....	12
Figure 5. Utilization per Room.....	13
Figure 6. Utilization of the IR Division per Hour Highlighting Turnover Times.....	14
Figure 7. IR Room Utilization Per Room per Shift.....	15
Figure 8. Percentage of Anesthesia Cases.....	17
Figure 9. Time Study 1.....	19
Figure 10. Time Study 2.....	19
Figure 11. Time Study 3.....	20
Figure 12. Time Study 4.....	21
Figure 13. Time Study 5.....	21
Figure 14. Time Study 6.....	22
Figure 15. Time Study 7.....	23
Figure 16. Time Study 8.....	23
Figure 17. Time Study 9.....	24
Figure 18. Time from when set-up is complete until new patient enters room.....	25
Figure 19. Time between patient arrival and doctor arrival.....	25

Executive Summary

The Interventional Radiology (IR) division at the University of Michigan Health Systems believes that there is opportunity to increase utilization of rooms in the division to better accommodate all patients who need a radiology procedure performed. The team had been asked by the Director of Radiology Clinical Operations, Karen Keast, to observe room turnover and quantify room utilization.

Methods of data collection and analysis

To quantify room utilization, the team collected 219 data points during a time with patient volumes at a normal level. The data included the state of each room in the IR division, whether the case was for an inpatient or an outpatient, whether an anesthesiologist was needed, whether a fellow was present, and whether the technologist was filming at the time. The team developed a time collection schedule to maximize the coverage from 7:00 am – 8:00 pm, Monday through Friday, which are the division's hours of operation. Data points were collected every 15 minutes during this time period. After the utilization measures were collected, the team performed time studies of 9 room turnovers. The team analyzed the data and developed recommendations to increase room utilization based on their analysis. The team then used modeling to find the expected impact of their recommendations on the IR division and developed an action plan to implement their recommendations.

Key Findings and Recommendations

By analyzing utilization in rooms 1,2,3,5 and 6, the team was able to define utilization throughout the division. Based on the 219 data points of utilization measures collected between October 11 and November 21, 2005, the team calculated the utilization of the IR division as 66%.

IR Division has 14% opportunity to increase utilization

In the article "OR Efficiency," OR Manager defines utilization as "the percentage of available OR time that is used for surgical cases." Available time refers to time the rooms are staffed and available to schedule cases during prime time hours, in this study, IR rooms 1, 2, 3, 5, 6, Monday – Friday 7:00 am through 8:00 pm. The analysis of the utilization measurement study was based on a target utilization of 80%.

Room 6 utilization is at 48%

Analyzing utilization percentages per room revealed that room 6 was utilized only 48% of the time observed, while the other 4 rooms were operating at or above 65% utilization. The team has discovered that this is true for 2 reasons. Room 6 is the smallest room and offers the lowest technology compared to the other rooms, limiting the number of procedures that can be performed in this room. Also, room 6 is blocked off for Neuro-IR procedures until 1:00 pm. With this consideration, the team recalculated utilization in room 6 from 1:00 pm- 8:00 pm, and found that the utilization decreased to 33%.

Based on these findings, the team recommends the following:

1. Schedule simple procedures in room 6 first

Which will:

- Increase utilization of room 6 to 56% based on modeling
2. Reduce time allotted to Neuro-IR
 - Increase capacity in room 6

Analysis of utilization percentages per hour revealed a high level of inconsistency throughout the day. The team is aware that after 6:00 pm, the staff is reduced to only support rooms 1 and 2, and therefore also defined utilization to only include rooms 1 and 2 during these times. Table 1 lists the key findings from analyzing utilization data at different points in the day.

Table 1. Summary of utilization percentages

Utilization from 7:00-8:00 am	0%
Utilization in the morning (7:00 am – 11:15 am)	62%
Utilization in the afternoon (11:15 am – 3:30 pm)	80%
Utilization in the evening (3:30 pm – 8:00 pm)	53%

Based on these findings, the team recommends the following:

1. Begin first procedure in each room at 7:00 am
 - Which will:
 - Increase number of patient cases per day by 6 based on modeling
 - Increase utilization percentage to 100% at 7am based on modeling
2. Operate at constant 80% utilization throughout day
 - Which will:
 - Level workloads (Heijunka)
 - Optimize worker utilization in IR, allowing for emergent cases in schedule

Time Studies

The team conducted 9 time studies on the room turnover process in the IR division. Time studies revealed a high level of variability in both job sequence and turnover time. The key findings from time studies are listed below in Table 1.

Table 2. Key findings from time studies

Average room turnover time	0:44:30
Range of room turnover times	0:22:48-1:04:22
Average room set up time	0:25:52
Range of room set up times	0:12:23-0:38:21
Average room set up time with pre-set up trays	0:15:58

Based on these findings, the team recommends the following:

1. Standardize room turnover in IR division
 - Which will:
 - Eliminate job function confusion
 - Eliminate tasks being overlooked
 - Obtaining consent

- Calling anesthesiology
 - Hand-off of job functions when staff or faculty are absent
 - Create most efficient and effective process
 - Create “Standardized Work Instructions” for each job function
 - Operate at maximum worker efficiency
 - Clear job responsibility
 - Eliminate non-value added tasks
 - Waiting, excessive walking, multiple handling reduced
 - Reduce turnover time
 - Increase capacity in IR division
 - Increase utilization in IR division
2. Set up trays in advance of procedure
Which will:
- Reduce turnover time by approximately 15 minutes
 - Perform turnover faster by eliminating task
 - Create a buffer for more efficient patient throughput
3. Introduce visual cues and pull system between IR room and prep/recovery (kanban)
Which will:
- Reduce time rooms are empty
 - If reduce by 80%, utilization would increase to 75% based on modeling
 - Reduce time between set-up completion and patient entering room
 - Kanban would pull patient to eliminate time between processes
 - Improve information flow
 - Reduce human error
 - Aid in managing board and patient scheduling
 - Reduce time between processes

Although the team has recommended opportunities to increase utilization in the IR division, further analysis is needed to determine whether other factors outside of this project’s scope are affecting the overall utilization percentage in the IR division. For example:

- What is room turnover “best practice?”
 - Reduce time between cases
 - Walk paths
 - Job sequence
- Can consent be obtained more efficiently?
 - Reduce time between cases
- Can inpatient transport be more efficient?
 - Reduce people involved in process
 - Reduce time between cases
- Can patient scheduling be more efficient?
 - Increase throughput of patients
- Can task be moved from the IR division to prep/recovery?
 - Reduce average times for procedure and room turnover

Introduction

Currently the Interventional Radiology (IR) division of The University of Michigan Health Systems (UMHS) believes there is opportunity to increase room utilization. Therefore, the Director of Radiology Clinical Operations asked the team to observe room turnover and quantify room utilization. After the team observed the division and collected data, the team analyzed the information and developed recommendations to better accommodate patient flow and optimize the usage of the current IR rooms. The purpose of this paper is to present findings from the project, make recommendations, and propose an action plan to implement the recommendations in the IR Division.

Background

The IR division performs over 85 different procedures. These procedures are performed on both inpatients and outpatients, which are scheduled differently. Usually outpatient cases are scheduled in advance, while inpatient cases are fit in between scheduled appointments. Before a case may begin, the following must occur:

- Consent must be obtained
- Lab values must be approved
- Patient must be present
- One doctor, nurse, technologist, and sometimes an anesthesiologist must be present
- Room must be ready

In addition, the IR division is on call for emergency procedures 24 hours a day, 7 days a week. These emergent procedures always pre-empt scheduled cases.

Although the IR division's hours of operation are 7:00 am to 8:00 pm, Monday through Friday, the division is not fully staffed for their entire hours of operation. The division considers the times shown in table 3 below to be the hours staffed in the IR per room.

Table 1. Hours Staffed in the Interventional Radiology Division per Room

Room 1	7:00 am – 8:00 pm	Monday – Friday
Room 2	7:00 am – 8:00 pm	Monday – Friday
Room 3	7:00 am – 6:00 pm	Monday, Tuesday, Wednesday, Friday
	7:00 am – 8:00 pm	Thursday
Room 5	7:00 am – 6:00 pm	Monday - Friday
Room 6	7:00 am - 4:00 pm	Monday – Friday
	7:00 am – 1:00 pm	Blocked off for Neuro-IR

Key Issues

The following key issues were considered as potential opportunities to increase efficiency in IR room utilization:

- Scheduling of necessary staff
- Obtaining necessary lab values

- Communication in preparing an inpatient for a procedure
- Completion of consent forms
- Limitations in room functionality
- Variability in room turnover

Goals and Objectives

In order to observe room turnover and quantify room utilization, the team has performed the following tasks:

- Conducted utilization sampling of IR rooms
- Collected 219 utilization data points of variables possibly affecting procedure timing
- Analyzed utilization data points to quantify utilization in the IR division
- Conducted 9 time studies on the cycle of room turnover
- Interviewed 8 key personnel in the division to define process flow
- Analyzed the last 2 fiscal years of department volumes to validate sampling method and sample period
- Performed literature search to confirm definition of room utilization and set a target goal for room utilization based on similar departments

With this information, the team has developed the following:

- Recommendations to increase efficiency regarding room preparation and usage
- An action plan to implement the recommendations in the division

Project Scope

The project includes analysis of:

- Cases in rooms 1,2,3,5, and 6
- Cases during IR hours of operation (7:00 am to 8:00 pm, Monday through Friday)

The project excluded analysis of:

- Cases in Neuro-IR room 4
- Procedures, preparation and recovery time for patients that occurs outside of the IR division
- Cases that are performed outside of normal operating hours
- Cases outside of the IR division
- Cases during the week of October 17

The team did not collect data during the week of October 17 because several of the faculty members were on vacation, making the data unrepresentative of the population.

Approach and Methodology

The team completed the project in three steps:

1. Collected data:
 - Observations and interviews

- Utilization measures
 - Time studies
 - Historical data
 - Literature
2. Analyzed findings
 3. Developed recommendations and an action plan

Data Collection

Observations and Interviews

The team began data collection by interviewing eight key personnel to learn job functionality and processes in the division. The team then observed the division to better understand the variability and environment, to validate the process flow, and to solidify their methods of data collection.

Utilization Measures

The team created a schedule for collecting utilization measures to ensure the sample would range from Monday through Friday, 7:00 am to 8:00 pm. The team collected 219 utilization measurements between October 11 and November 23, 2005. A copy of the data collection sheet the team developed and used as well as a brief description of the collected items is in Appendix A.

Time Studies

Between November 8 and November 23, the team performed time studies of 12 room turnovers. The team first performed 3 time studies together to solidify their collection methods. Once the team felt the collection method was synchronized among members, the team collected 9 time studies to be used in data analysis. These time studies were collected to support and confirm the utilization measurements the team had already collected. The time study data collection sheet, as well as the definitions of collection points is located in Appendix A.

Historical Data

The team obtained patient volume statistics from the IR division for the Fiscal Years 2004, 2005 and the beginning of the fiscal year 2006. This information was used to confirm that data was collected at a time representative of past patient volumes.

Literature Search

The team used the article "OR Efficiency: Is an 80% to 85% utilization a realistic target for ORs?" from *OR Manager* in May, 1997 to define a target utilization percentage for the IR division.

Analysis of Findings

The team began data analysis during the data collection phase in order to test analysis methods. The team began to make interim conclusions based on the collected data, continually analyzing the data through the end of the data collection phase. After remaining data was collected, the team completed analysis.

Development of Recommendations

Based on the team's findings, both quantitative and observational, the team formulated conclusions and recommendations. The team then used both logic and modeling to predict the expected impact of each recommendation on the IR division. The team tested the recommendations with the client and coordinator in order to understand implications and possible resistance.

Results

The following section contains the results and findings of the project analysis. Each finding is presented with a corresponding recommendation, action plan, and expected impact section, if applicable.

Perceptions from Interviews

The team is aware that information acquired through IR staff interviews is perception, and may not be factual. Collected data was used to confirm or refute those perceptions.

During staff interviews, process flows for both patient throughput and room turnover were developed. These process flows were then validated by the team by observations.

The team interviewed eight members of the IR division's staff, including a physician assistant, a nurse practitioner, a radiology outpatient assistant, two IR radiology assistants, two technologists, and the nurse supervisor. Of the staff that was interviewed, all but one believes that there is a possibility to increase IR room utilization. The remaining staff members estimated utilization was between 70 and 85%. Although the staff believes that the rooms are not at maximum utilization, they believe that the staff is being utilized maximally, and often feel the need to be in several places, doing more than one task at a time. The staff perceived four main areas that were believed to be limiting IR utilization.

- Obtaining consent is difficult and sometimes slows the process. Recognition of patients that cannot consent for themselves needs to occur prior to patient arrival in preparation/holding.
- Room turnover slows the process. Rooms need to be turned over more efficiently and faster. This delay may occur because not all of the necessary staff is present to aid in the turnover process, or could occur as a result of changes in the next scheduled procedure demanding different tools.
- The pre-procedure process could be improved. Information is relayed between several staff members and locations, delaying the process. Obtaining patients' consent and lab values also proves to be difficult due to disconnects in the information process.
- Limitations arise due to the inflexible nature of certain rooms, such as inadequate space for needed staff members and inadequate equipment. Room 6 is limited by both technology and space, and is unable to support more complicated procedures and cases requiring anesthesia.

The staff believes that rooms 1 and 2 have the highest utilization, as they are the largest and some doctors prefer to be scheduled in those rooms first. After rooms 1 and 2, room 3 is perceived to be utilized the third most efficiently, followed by 5 and 6, respectively. The staff believes that Mondays and Fridays experience the most demand and the IR division is the busiest on those days. Also, most feel that the morning hours are the busiest time of the day. The demand that the staff has been encountering since data collection began is believed by the staff members to be a representative sample of the demand felt throughout the year.

Flow Charts

The team developed flow charts from both observing the department and interviewing staff members of the IR division. The charts depict tasks for each job function during both room turnover and patient flow in the department, and identify delays in those processes with the “D” shapes. (Figure 1)

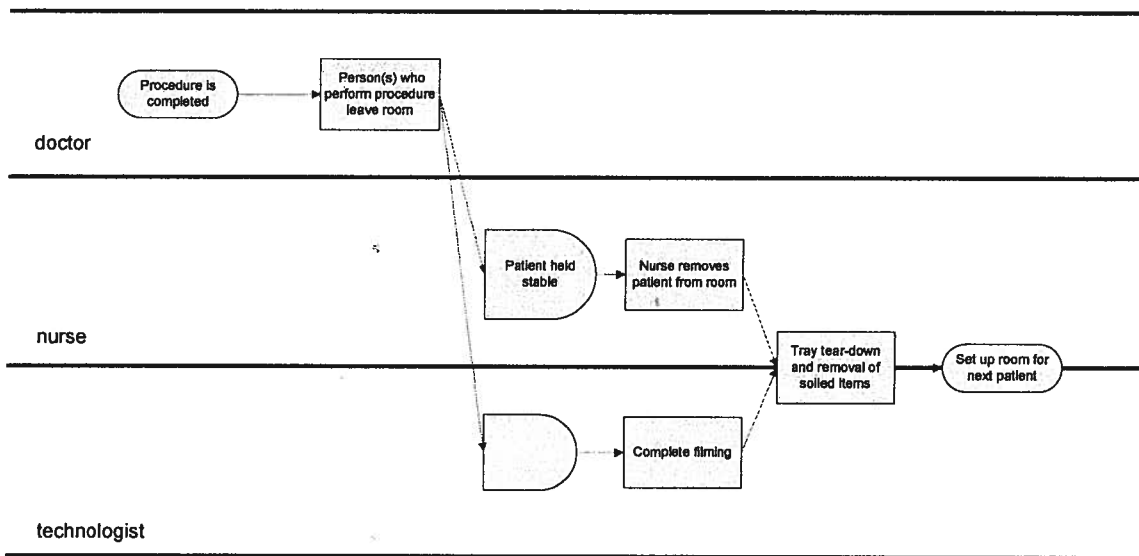


Figure 1. Room Turnover in the IR division

Figure 1 above depicts the process of room turnover in the IR division, from when the procedure is completed until the room is ready for the next patient to arrive. Delays in the process are between when the case is completed and the patient leaves the room, and when the trays are being torn down and the room is being set up for the next patient. This process is not followed for every room turnover. There is a high level of variability and tasks are not always performed in the same order. The team further analyzed this during time studies.

Figure 2 below depicts the process of obtaining a patient and bringing that patient to an available room.

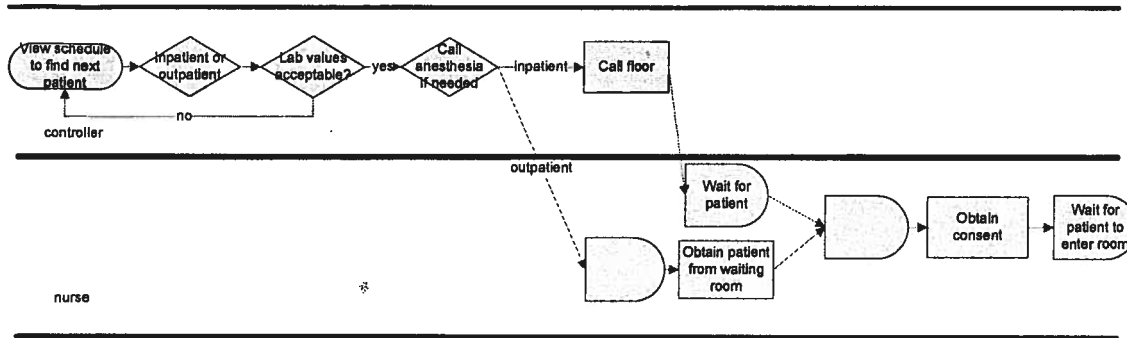


Figure 2. Patient Flow

As identified in Figure 2, there is a delay when the division is waiting for an inpatient to be brought to the preparation area. After the patient is in the preparation area, obtaining consent sometimes delays the process of bringing the patient to the IR room. The team used time studies to further analyze delays in patient flow that are in the scope of this project.

Historical Data

The team analyzed the historical data in order to determine normality of the period of time in which data was collected for the project. The following graph summarizes the information the team received.

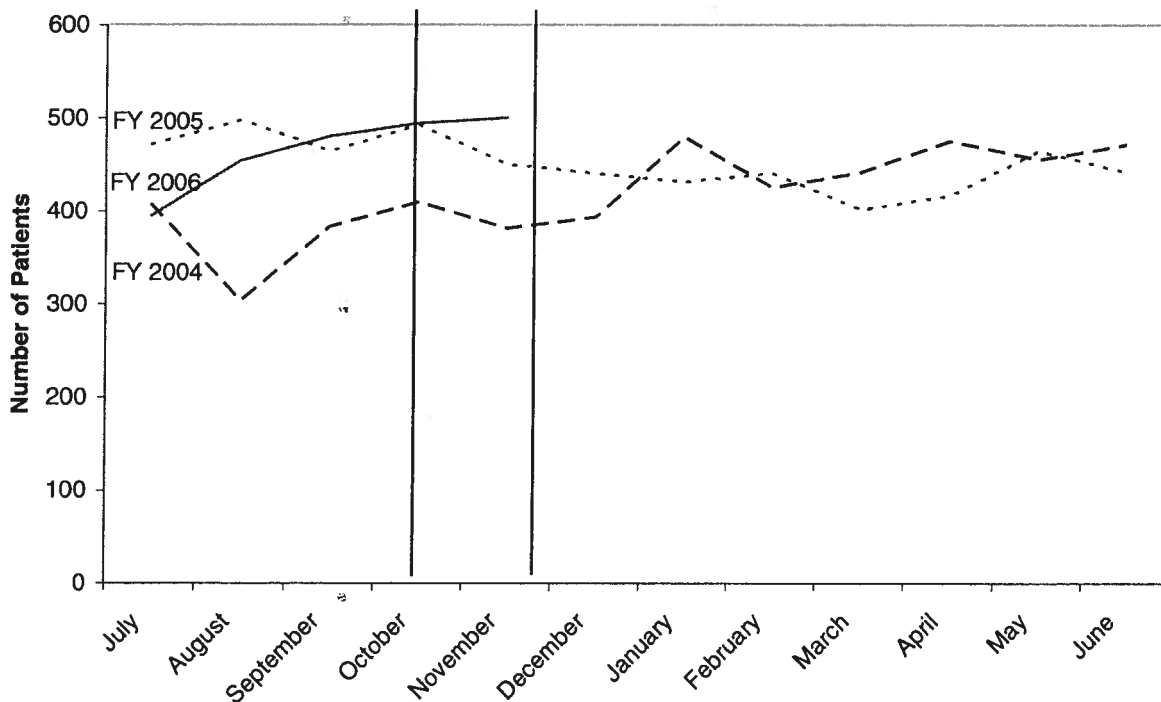


Figure 3. Visceral Statistics for Patient Volumes of IR Division

Figure 3 shows that the month in which the team collected data experienced volumes similar to that of fiscal year 2005, and slightly higher than those of 2004. The team also verified that the collection of the utilization measures covered the full scope of days and hours of operation identified in the scope. Certain hours of the week were unable to be represented due to other academic obligations of the team, however hours sampled are sufficient to gain an accurate picture of the overall utilization. A chart of the total time covered can be found in the appendix. (Appendix C. Utilization Measures: Hours Collected) The team can therefore use all subsequent findings to produce recommendations for the division.

IR Division Room Utilization

In the article “OR Efficiency,” OR Manager defines utilization as “the percentage of available OR time that is used for surgical cases.” (Patterson, Works Cited) Based on OR Manager’s definition of utilization, the team defines utilization as the sum of the pre-procedure, procedure, and turnover times in IR rooms 1, 2, 3, 5, 6, Monday – Friday 7:00 am through 8:00 pm.

The analysis of the utilization measurement study was based on a target utilization of 80%. This was decided based on the article from OR Manager. “Experts agree that 80% to 85% is the maximum utilization an OR can be expected to reach.” (Patterson, Works Cited)

Based on the data collected between October 11 and November 23, 2005, and covering the hours of 7am-8pm Monday-Friday for rooms 1, 2, 3, 5, and 6, the team calculated the total percentage of each room state. See figure 4 below.

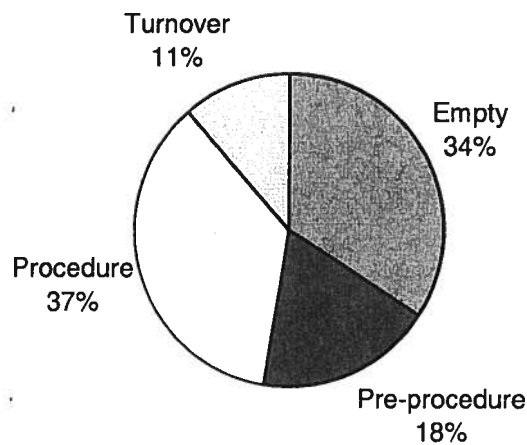


Figure 4. Room State Percentages

Interventional Radiology division utilization is currently 66%. This calculation of utilization is based on the division’s hours, and is therefore from a customer perspective. Based on the target utilization of 80%, the Interventional Radiology division therefore has 14% opportunity to

increase utilization. The successive findings from the study and recommendations can potentially increase the room utilization to be closer to this goal.

When considering utilization from a staffing perspective, the division is at 71% utilization. This is based on the staffing schedule that is shown in Table 3. Since this project is defining utilization of the IR division, successive calculations will be based on utilization from a customer perspective, spanning 7:00 am – 8:00 pm for rooms 1,2,3,5, and 6, unless otherwise noted.

Individual IR Room Utilization

When analyzing the data, the team also considered utilization of each individual room. Each room is slightly different, both in square footage and equipment available. A representation of individual room utilization based on the utilization measures is shown in Figure 5.

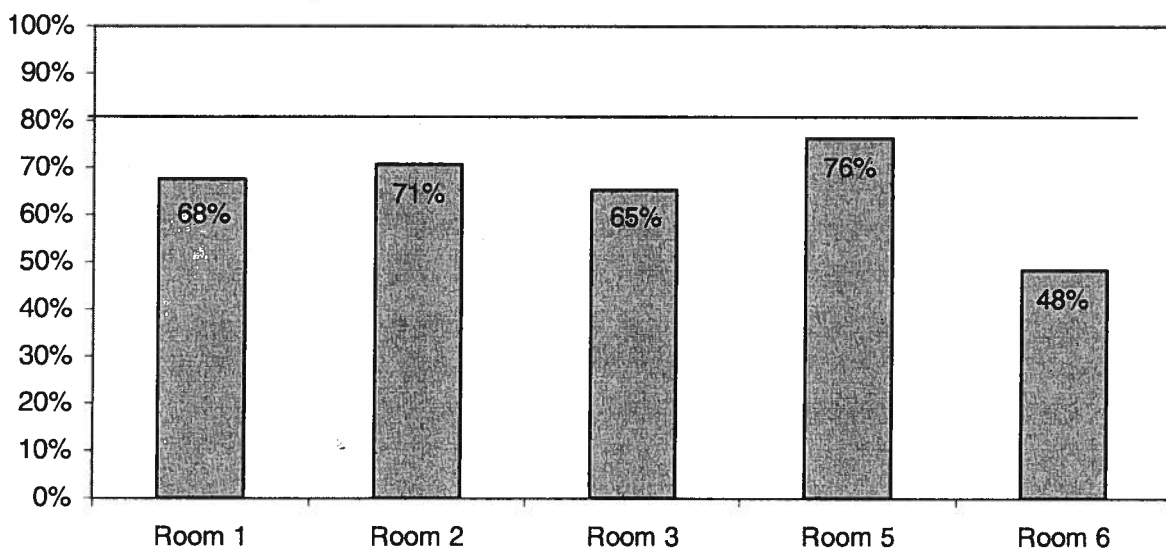


Figure 5. Utilization per Room

Figure 5 shows that room 6 has the lowest utilization at 48%, while the other 4 rooms are operating at or above 65% utilization. The utilization of room 6 is the lowest for two reasons. First, room 6 is the smallest room and is the least equipped when compared to the other rooms, which limits the number of interventional procedures that can be performed in room 6. Also, room 6 is scheduled for Neuro-IR procedures until 1:00 pm. With this consideration, the utilization was recalculated for room 6 from 1:00 pm- 8:00 pm. This reduced the utilization slightly to 45%, suggesting that room 6 has the potential for utilization to be increased by 35%.

Based on these conclusions, the team recommends that smaller and simpler procedures such as PICC lines be scheduled to room 6 before larger rooms. Implementing this recommendation would increase the number of cases that room 6 holds, and would free the larger rooms to accommodate more complicated procedures and better utilize their equipment.

To predict an expected impact of this recommendation, the team modeled new data in which a procedure would be performed in room 6 for every block of time the room was empty for over

1.5 hours. Based on the length procedures and turnovers observed by the team, 1.5 hours would be enough to accommodate a short procedure and allow for enough time to set up for the next case. For this model, the team considered the hours of operation for the division. Based on this model, this recommendation could increase the utilization of room 6 to 74%, which is consistent with other rooms in the division. This increase in room 6 utilization would translate into performing 1 additional procedure to room 6 per week. It would also bring total utilization in the IR division to 71%.

The team also recommends a smaller time be blocked off for room 6 to be used for Neuro-IR. From 7:00 am – 1:00 pm, Neuro-IR is utilizing the room 53% of the time. If room 6 was available to the rest of the IR division before 1:00 PM, the overall utilization could be increased.

To increase utilization in room 6, the team suggests increasing communication with Neuro-IR. The utilization of both time blocks from 7:00 am – 1:00 pm and 1:00 pm – 8:00 pm are 27% and 35% below the target utilization, respectively. By increasing communication between the two groups, a better schedule may arise in order to better accommodate both groups.

IR Utilization per Hour

The team then analyzed the utilization of the IR division per hour.

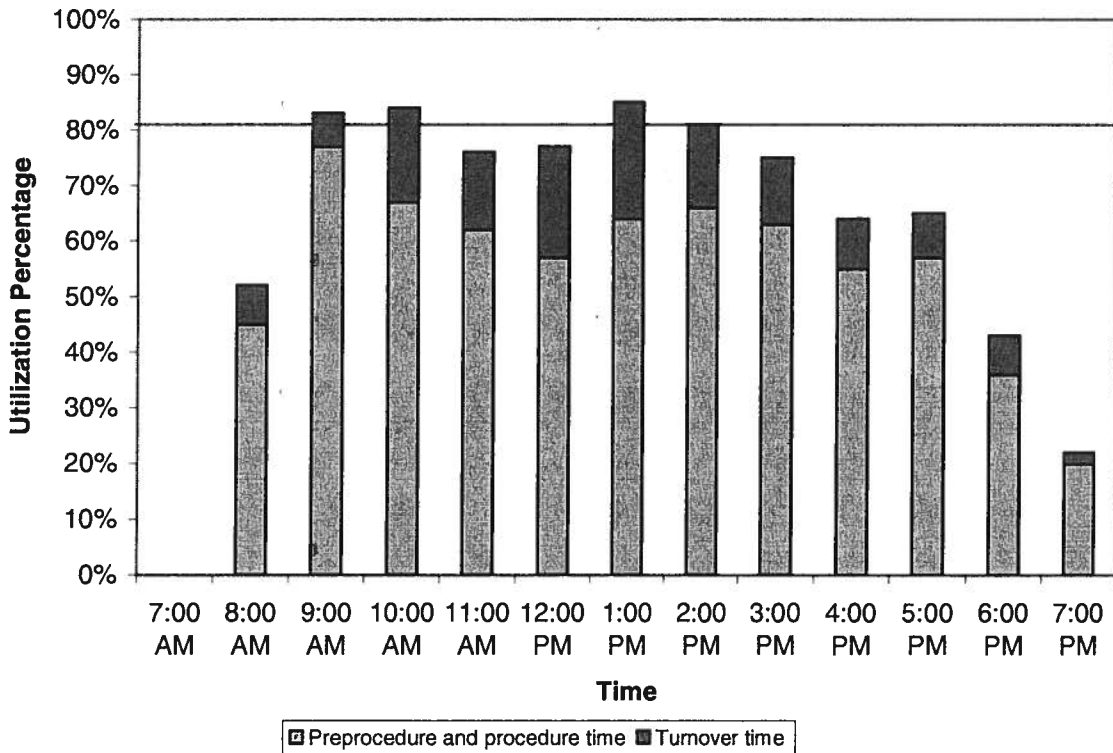


Figure 6. Utilization of the IR Division per hour highlighting turnover times

Figure 6 shows the utilization per hour in the IR division from 7:00 am – 8:00 pm. This utilization is divided into pre-procedure + procedure times and turnover time.

There is a high level of variability in utilization throughout the day. All rooms are empty from 7:00 am to 8:00 am. At 8:00 am, the division increases to 52% utilization. After 8:00 am, the IR division is utilized at about 80% from 9:00 am to 4:00 pm. Between these times, the division is utilized above 80% for 4 hours. At 4:00 PM, the division’s utilization slowly decreases throughout the evening.

Due to the inconsistent level of utilization, the team further analyzed the utilization in the IR division by dividing the hours of operation into three blocks. These blocks represent “morning”, “afternoon”, and “evening”. Block 1 runs from 7:00 am to 11:30 am, block 2 runs from 11:30 am-3:30 pm, and block 3 runs from 3:30 pm to 8:00 pm.

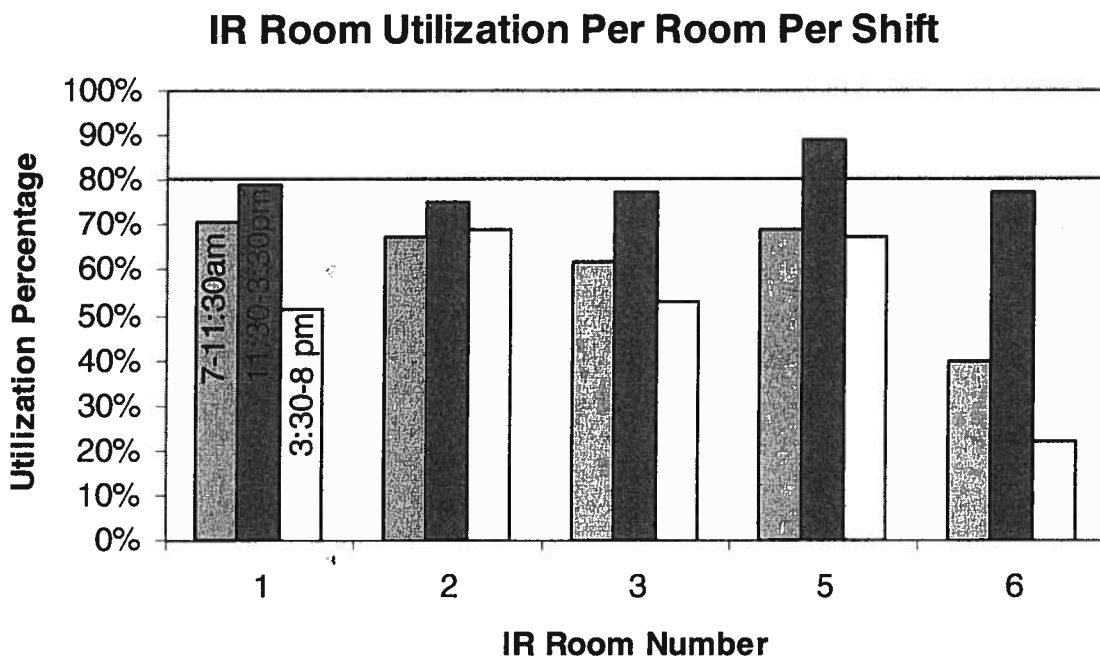


Figure 7. IR Room Utilization Per Room per Shift

Figure 7 shows that all of the rooms are near the 80% utilization target for the afternoon with room 5 being the most utilized during this time block. The afternoon time block (11:30 – 3:30 pm) has a higher utilization percentage than both the morning and evening blocks for all IR rooms. Figure 7 also validates that room 6 is the least utilized in both the morning and evening blocks has the greatest variability in utilization throughout the day. Room 2 has the most consistent utilization throughout the day.

Conclusions from utilization per hour and utilization per room per shift

Currently, the division is running at an inconsistent level of utilization. Rooms are not being utilized efficiently from 7:00 am – 8:00 am, and resources are being strained when the division operates above 80% utilization in the late morning and early afternoon. The article in OR

Manager states that “over [the target percentage] the department loses flexibility and needs to consider added capacity”. Since the division overall is not above the target utilization, added capacity is not necessary. Instead, the division must work to operate at a consistent 80% utilization.

Turnover accounts for 11% of total time in the division, which is high. If room turnover time could be decreased, the division would have opportunity to perform more cases per day and increase the amount of time available for cases in each room. This could increase the throughput of the division, and reduce the wait time for both inpatients and outpatients.

When room turnover is separated from pre-procedure and procedure time, it becomes obvious that there is a large dip in utilization during lunch hours. Turnover may take longer during these times when staff members relieve each other to allow for lunch breaks. For example, if a technologist has been present for a procedure and is relieved for lunch by another technologist at the end of the procedure, it would take longer for the relief technologist to finish filming and paperwork than it would for the technologist that was present for the procedure. The time it would take for the relief staff member to learn the case could increase the time needed for turnover.

With an inconsistent amount of time spent for room turnover throughout the day, analysis regarding room turnover processes becomes even more important.

Recommendations from Utilization per Hour and Utilization per Room per Shift

Based on the findings from utilization per hour and utilization per shift per room, the team developed two recommendations.

1. Begin the first procedure in each room at 7:00 am, beginning the day at 100% utilization.
2. Operate at a constant 80% utilization throughout the day.

By beginning each procedure at 7:00 am, the division will be able to increase the utilization in the first hour of the division to 100% utilization. After the initial procedures have been completed, the division should run at a constant 80% utilization. This would allow the division to be utilized maximally without straining physical resources, staff, and faculty.

Implementing Recommendations

To ensure a 7:00 start time, a nurse or PA should gather a folder of all necessary information regarding a patient the day before, in cases that are known in advance. This information folder would contain patient lab values, consent, x-rays, and other information necessary for the doctors to review before the procedure begins. The doctor will be presented with this information packet before 7:00 am, and will need less time to review the case. This will reduce the non-value added time needed in the morning before the first case is under way. Reviewing cases day prior to avert delays with inadequate lab values and obtaining consent will therefore reduce the non-value added time in the morning before the first case is under way.

To keep the division at a constant 80% utilization throughout the day, patients will need to be scheduled to support 80% utilization. Rooms will not be able to sit open while waiting for patients to arrive. If the next patient is not available when a room is available, that patient will need to be skipped and a patient that is available will take the available room. To maintain 80%

utilization, rooms will be empty for 2 hours, 36 minutes between 7:00 am and 8:00 pm. This schedule will allow each room to be empty for 31.2 minutes throughout the day, which will occur automatically.

Anesthesiologist Case Findings

While collecting utilization measures, the team noted if cases needed an anesthesiologist to determine if anesthesiologists affected room utilization. Before analyzing this data, the team determined the percentage of cases with and without anesthesia.



Figure 8. Percentage of Anesthesia Cases Observed

The team observed 146 cases, with only 12 requiring anesthesiologists, which is only 8% of the total cases, as shown in Figure 8. This amount of data was not sufficient to make any conclusions on the effect of anesthesiologists on room utilization. The team recommends conducting another project to study the potential effect of anesthesiologist needed cases on room utilization.

Fellows

The team also noted during collection of utilization measures whether a fellow was performing the procedure. After observing the IR division and collecting data, the team concluded that whether the procedure is performed by a fellow or faculty doctors does not affect room utilization. Awaiting the arrival of a doctor to perform a procedure could impact utilization, regardless of whether the doctor is a fellow or faculty. Therefore, no further analysis of this data was performed.

Findings of Technologist Filming

The team collected data on when the technologist was filming during the collection of utilization measures. The team wished to use these data points to determine the percentage of cases that the technologists film both during the procedure and after the procedure, but the method of data collection barred the team from making conclusions based on these data points. Filming a procedure can take as little as 30 seconds, and the team took utilization measurements every 15 minutes, therefore limiting the number opportunities to observe a technologist filming. A technologist was filming 59 of the 146 cases that the team observed.

Of the cases the team observed a technologist filming, 57% were filming during turnover. Again, a high level of variability was observed. There was no standard practice of whether a technologist filmed during a procedure or after a procedure. Therefore the team recommends standardizing the filming process. The action plan for standardizing this and other job elements and functions is addressed later in the report.

IR Time Study Results

Although utilization in the IR division appears to be close to the targeted 80%, this percentage is inflated by long room turnover times. These long turnover times keep the utilization percentage high while limiting potential patient throughput. The team analyzed nine time studies of room turnover to confirm turnover times were limiting the IR division's throughput. From these time studies, recommendations were made to create a more efficient turnover process in the IR division. Although limiting room turnover time will not increase the IR division's utilization percentage, it will allow for an increase in patient throughput.

Below are flow charts of the 9 IR room turnovers the team observed.