**ANALYSIS AND IMPROVEMENT OF OPERATING ROOM UTILIZATION AND EFFICIENCY AT UPMC MERCY**

by

**Latisha Sureshkumar Koli**

Bachelor of Dental Surgery, D. Y. Patil University, India, 2016

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This essay is submitted

by

**Latisha Sureshkumar Koli**

on

April 25, 2019

and approved by

**Essay Advisor:**

Tina Batra Hershey, JD, MPH

Assistant Professor

Health Policy and Management

Graduate School of Public Health

University of Pittsburgh

K. Louis Luangkesorn, MS, PhD

Assistant Professor

Industrial Engineering

Swanson School of Engineering

University of Pittsburgh

Julie Hecker, MS

VP of Operations

UPMC Mercy

1400 Locust Street

Pittsburgh, PA 15219

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Tina Batra Hershey, JD, MPH

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**ABSTRACT**

Operating rooms are the heart of the hospital, impacting patient flow throughout the hospital, particularly from the ED (Emergency Department) and the ICU (Intensive Care Unit). It is necessary to keep the heart (Operating Room) of the body (Hospital) functioning at its best to ensure smooth functioning of the other organs (Departments) of the body.

Surgeries are a part of a major events in the lives of patients and their families. The entire Operating Room experience has a significant impact on patient satisfaction which is in interest of public health. Hence, it behooves the hospital to make this experience as comfortable and as smooth for patients and their families as possible for public health relevance.

ORs represent a significant amount of investment in terms of facility, equipment, staffing and supplies, which makes it necessary to utilize them to their maximum capacity and in the most efficient manner. A well organized and managed OR has a tremendous impact on the financial stability of the organization.

There are 15 major general operating rooms where general surgeries are performed, 2 Cysto operating rooms (Urological procedure rooms) that are similar to the general operating rooms but smaller in size and where smaller procedures are performed and 6 same day surgery operating rooms established at UPMC Mercy. The operating rooms operate from 7 am to 3pm.

**TABLE OF CONTENTS**

**PREFACE………………………………………………………………………………………vii**

1. I**NTRODUCTION……………………………………………………………………………1**
   1. ABOUT UPMC MERCY…………………………………………………………….1
   2. PROBLEM STATEMENT…………………………………………………………...2
2. **BACKGROUND…………………………………………………………………………….4**
   1. OR UTILIZATION EFFICIENCY MODELS………………………………………..4
   2. BEST PRACTICES…………………………………………………………………..7
   3. METHODS TO IMPROVE OR EFFICIENCIES…………………………………….9
3. **EXPECTED OUTCOME…………………………………………………………………..11**
   1. IDENTIFIED STAKEHOLDERS…………………………………………………...11
   2. ASSUMPTIONS……………………………………………………………………..12
4. **DESIGN METHODOLOGY AND DATA………………………………………………..14**
   1. OPERATIN ROOM SCHEDULE…………………………………………………...15
   2. UPMC SYSTEM POLICY…………………………………………………………..16
5. **FINDINGS/RESULT……………………………………………………………………….18**
6. **ANALYSIS………………………………………………………………………………….24**
7. **RECOMMENDATIONS…………………………………………………………………...26**
8. **CONCLUSION……………………………………………………………………………..28**

**BIBLIOGRAPHY………………………………………………………………………………29**

**LIST OF FIGURES**

Figure 1: Operating room schedule for the month of July 2018……………………………..15

Figure 2: General operating room utilization from July 2018 to August 2018……………...18

Figure 3: General operating room utilization from September 2018 to October 2018………19

Figure 4: General operating room utilization from November 2018 to December 2018……19

Figure 5: Same day surgery utilization from July 2018 to August 2018…………………….20

Figure 6: Same day surgery utilization from September 2018 to October 2018…………….21

Figure 7: Same day surgery utilization from November 2018 to December 2018…………..21

Figure 8: General operating room utilization for Wednesdays from July 2018 to December…………………………………………………………………………………….22

Figure 9: Same day surgery utilization for Wednesdays from July 2018 to December

2018…………………………………………………………………………………………..23

**PREFACE**

It is my pleasure to be indebted to various people who directly or indirectly contributed in the development of my project. Some specific individuals I would like to thank include:

* My primary reader, Prof. Tina Batra Hershey, for her consistent support, cooperation, and motivation provided to me for the completion of this essay. It would not have been possible to complete this project without her expertise and guidance on this endeavor.
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* My sincere appreciation to all the staff of UPMC MERCY for providing me with the data and resources required for the completion of this project.

**1.0 INTRODUCTION**

**1.1 ABOUT UPMC MERCY**

UPMC Mercy, initially The Mercy Hospital of Pittsburgh, was the first hospital in Pittsburgh and the first Mercy Hospital in the world. It was established in 1847 by the Sisters of Mercy. It merged with UPMC to be known as UPMC Mercy effective January 1, 2018.

The mission statement of UPMC Mercyis having Mercy, Compassionate, Quality Care and Reverence for All.

Their vision statement is UPMC Mercy in partnership with the Catholic Church will be a transforming and healing presence in the Pittsburgh Region. Their health care providers and valued associates will deliver clinical and service excellence with an unwavering commitment to everyone we serve, especially those who are poor and vulnerable.

Through their efforts, they will create healthier communities with enhanced access to care by providing a continuum of health care services, professional and community education, and tireless service to all.

### Their values include providing quality and safety by creating a safe environment where quality is their guiding principle, having dignity and respect for all individuals, caring and listening for all their patients, their health plan members, fellow employees, physicians and their community, they perform their work with highest level of responsibility and integrity, excellence and innovation by thinking creativity and building excellence into everything they do.

For many years, UPMC Mercy has been delivering a wide range of medical services to the people of Pittsburgh and beyond through its advanced technological expertise, advanced care practices and laser treatments.

In addition, UPMC Mercy has been providing surgical services for various service lines. There are 15 functional general operating rooms located on floor 3 of the hospital. There are also 2 Cysto operating rooms and 6 Same day Surgery operating rooms established at UPMC Mercy.

**1.2 PROBLEM STATEMENT**

Increasing the operating room (OR) efficiency has always been a challenge for hospitals. This study addresses OR efficiency. The main objective is to identify the barriers in current OR scheduling that affects efficiency which is being reflected in the utilization reports generated by UPMC’s corporate finance team. The finance team issues an OR efficiency report every quarter. The UPMC Mercy’s report depicted poor OR efficiency as compared to the other hospitals system wide. The aim of this study is to answer the following questions:

1.      What are the metrics used by UPMC Mercy to evaluate OR efficiency?

2.      What are the barriers leading to reduced efficiency in the OR?

3.      What are the potential solutions to improve/increase OR efficiency?

It is essential to study the existing OR functions and operations to evaluate the existing efficiency and suggest solutions to improve or increase the efficiency which is reflected in the financial reports.

**2.0 BACKGROUND**

**2.1 OR UTILIZATION EFFICIENCY MODELS**

There are many factors that can be adopted in hospitals that will improve efficiency and save dollars to the hospital. Below are some of the methods that can be implemented in hospitals given by Beckers Hospital Review (Molly Gamble, January 18, 2013)

1. To build support among the hospital physicians to reduce the supply costs: This may include enhanced and consistent communication with the physicians which can be a problem at many places. It is essential to analyze cost by procedures and surgeons. It is also important to share this information with the surgeons in regular intervals so that they are made aware of how their service line is doing and how it is affecting the hospitals costs. One more important factor to be considered is the costs of the medical devices. There should be efforts made by all service lines to have only the medical equipment in accordance to the national standards, avoiding unnecessary costly equipment. If service line is using medical equipment that are very costly as compared to the national standards, it is the responsibility of the OR manger and the CMO should meet with the surgeons to discuss having a ceiling price over the medical equipment.
2. Blocking time: Scheduling the surgery block times is one of the most important indicators for OR efficiency. It is most efficient to block the OR times according to whole days.
3. Adjusting OR block times and releases: Usually surgeries are scheduled according to the surgeon utilization rates. This is the most widely accepted model. However, recent studies have shown that this might not always be beneficial for the hospital and that the hospital can still lose money if the surgeon having the high utilization rate still does cases that have a lower rate of reimbursement that might not cover the costs of the surgery. Hence there needs to be a balance in OR scheduling cases between under and over utilization of the OR. The hospital loses money if the OR is underutilized and the hospital also loses money if overtime is overutilized as it must cover the charges of the utilization as well as OR staffing. It is the responsibility of the OR managers to schedule the surgeries keeping this balance in mind. Released time is the time when no surgeries are scheduled in the block time. Released times should be utilized to schedule other surgeries that might go over the block time. This will help save the hospital significant costs by avoiding overtime. Release of time depends on the service lines and the surgery of their cases. For example, orthopedics department may release their block times well in advance, like in the case of a cancelled knee replacement surgery which is considered an elective surgery. However, cardiac surgeons may not release their block time until the day of surgery as their cases are most commonly urgent or emergent. Block release allows the OR manger to be more efficient in managing utilization of the OR.
4. Proactively avoiding wasting times due to technical problems: Having daily meeting or huddles where the cases are planned in advance and the necessary equipment is discussed would be beneficial. This will avoid any time loss between surgeries. They should always be mindful of simultaneous surgeries that may require the same equipment. This may cause a time gap which will reduce the overutilization.
5. OR start time: Tardiness in the OR start time will have consequences for surgeries scheduled later in the same day. For example, a delay in 30 minutes in the first case will lead to delays in all future cases leading to overtime. The total length of tardiness grows larger as the days goes by as the total duration of the cases ahead increases. To curb tardiness, it is the responsibility of the OR staff to have all the necessary paper work like medical records and consent forms completed in advance and also have all the equipment ready and checked prior to the scheduled surgery time. They should also tell the patient when they should arrive before the surgery and what pre-surgery protocol they should follow to avoid any last-minute delays or cancellations. They should also schedule surgeries in the following order, from the most predictable to the least predictable to help avoid any delays or change in the schedule on the day.
6. Controlling turn over times: Turnover times are the times between surgeries, after the patient leaves the OR and the new patient enters the OR. This time allows for the cleaning of the OR and preparation for the next surgery. Expected turnover is typically 30 minutes and delays are any additional time after that. Many hospitals focus on reducing the turnover times to improve efficiency as the surgeons believe this is lost OR time that could have utilized. However, research has shown that reducing turn over times will buy only limited additional time in the day thus turnover is not a significant factor driving the OR utilization rates.

**2.2 BEST PRACTICES**

One best practice to improve OR efficiency would include scheduling elective surgeries effectively and having OR staff to support the surgeries efficiently, which will lead to increased surgery volume, decreased overtime costs, less overtime and a better employee satisfaction. All these efforts should contribute to increasing the revenue of the hospital as a whole. This has been reported at one mid-sized U.S. based hospital, Mayo Clinic in Jacksonville, Florida and was discussed at the annual meeting of the Southern Surgical Association. This best practice was implemented at the hospital which led to having a surgical schedule that was more predictable and reliable with the operational costs associated with the OR being reduced. This was discussed by Dr. Smith, professor and chairman of the department of surgery at the Mayo clinic. (Mitchel L. Zoler, January 17, 2013)

Mayo Clinic, Jacksonville is a 214-bed facility that opened in the year 2008 with 21 OR, 28 ICU’s and about 12,000 surgeries performed each year. Inadequacies were identified in the surgical scheduling methods at the hospital by Dr. Smith and the other staff members. There were wide fluctuations reported, with a range between 35 and 62 cases per day. This wide range resulted in large variability in staffing: at times they were understaffed and at time they were overstaffed.

Another issue identified with the Mayo Clinic’s OR model was in scheduling of unavoidable surgeries. The inclusion of these inevitable surgeries was a problem because that led to a disruption in the scheduling of elective cases. Such disruption caused these cases to be pushed post 5 p.m., leading to the surgeon’s inability to work with their preferred team.

The key findings reported from The Mayo Clinic’s assessment in 2009 included:

1. Less than 65% utilization during prime hours,
2. Paying overtime to 15 full time equivalent employees, and
3. Low levels of OR surgeons and staff satisfaction.

To overcome these challenges, the Mayo Clinic began the process of revamping its OR scheduling with the goal to increase their case volume, reduce their overtime and maintaining surgeries without causing a disruption in the elective surgeries schedule. They adopted the following strategies:

1. Designated ORs only for emergency and urgent cases,
2. Restricting scheduling of elective surgeries after 5 p.m, and
3. Reengineering the flow out of the OR and streamlining the process of patient flow.

After implementation of the change, the following results were reported in the first year:

1. Increased surgical cases by 4%;
2. Prime time OR use increased from 61% to 64%;
3. The number of overtime full time equivalent employees decreased by 2, to 27%;
4. Cost savings of more than $111,000;
5. Daily elective room changes decreased by 69%;
6. Staff turnover decreased from 20% to 12% which resulted in increased staff satisfaction; and
7. Total net margin increased by approximately $5 million, 5% in one year.

There is constant scope for improvement even with the above-mentioned results, as stated by Dr. Smith.

**2.3. METHODS TO IMPROVE OR EFFICIENCY**

Some researchers have demonstrated various ways to improve OR efficiency. (JV Divatia, P Ranganathan, 2015) According to these researchers, the efficiency of the OR depends on scheduling of surgeries, allocation of staff, equipment, time required for preparation and induction of anesthesia, performance of surgery, recovery from anesthesia, preparation of OR for the next patient and other resources. They have identified the following steps to improve OR efficiency:

1. Audit: They identified various parameters like accurate case-durations estimation during OR audits. Audits is considered as a performance parameter for scheduling. Many people may be opposing to audits because of lack of standard definitions for various OR processes, differences between studies in terms of methodology used to calculate utilization, lack of validation of performance indicators. It is a difficult task to set OR benchmarks, and it depends on patient population, type of surgery, etc.
2. Percentage of on-time first case starting time: Delayed start times reflect inefficiencies in the hospital systems at various levels. Hence it must be made sure the cases start on time.
3. Pre admission screening, which is a measure of the percentage of cases that has a pre surgery checkup done earlier. Inadequacies in prescreening can lead to delays.
4. Average turnover time: It is the time when the patient leaves the OR and the next patient is brought in. The turnover times can be prolonged due to various reasons like lack of instrumentation, delayed cleaning of OR and more. It affects the start time of the next case and thus affects OR efficiency. This was not relevant at UPMC Mercy as the turnover time is very efficient.

According to best practices and the researchers, OR efficiency can be improved by making changes in the scheduling of elective surgeries, having efficient patient flow, regular auditing, accuracy of on-time first case start time, and average turn overtime.

**3.0 EXPECTED OUTCOME**

**3.1 IDENTIFIED STAKEHOLDERS**

As mentioned earlier, UPMC’s finance department releases the utilization report system wide and has noted that UPMC Mercy has lower OR efficiency. There may be reasons for this lower utilization and there may be ways to improve OR efficiency at UPMC Mercy. Existing gaps in OR data collection is likely one of the main reasons for reports showing lower utilization than the reality of what is occurring in the OR.

The executive leadership team expects certain stakeholders to take action to improve OR efficiency.

The various stakeholders identified in this study include:

1. Surgeons
2. Schedulers
3. Supporting OR staff
4. Clinician
5. OR management staff including the OR director, OR manager

The key stakeholders are the surgeons and the schedulers. Schedulers have one of the most important responsibilities: to plan the OR schedule while making as few changes as possible. They have to try to incorporate emergent cases effectively and also in a way that will allow for the fewest changes in the original schedule. Schedulers are also responsible for staff allocation, with the goal having to have the least overtime of staff as possible. Schedulers are also expected to maintain staff satisfaction in the OR to the maximum.

Surgeons should perform surgeries per the schedule during their block times, utilizing as little of outside block time as possible. They are expected to start promptly, as a delay in the start time will affect later cases, thereby affecting the utilization of all other surgeons.

OR management staff is expected to improve the current efficiency of the OR. They should study the existing OR utilization reports to improve outcomes. They are responsible for assuring that the schedulers, physicians and supporting staff utilize the OR effectively so that the OR is operated more efficiently. In addition, they are the leaders of the OR and are expected to act accordingly.

* 1. **ASSUMPTIONS**

I have made certain assumptions in order to drive the results of this study, which play a crucial role in the study. The assumptions are based on a background study of UPMC Mercy ORs, which support this study and have been taken into consideration in the development of the results and the recommendations provided later in this essay.

The following assumptions were made:

1. There is standardization of the surgeries performed and the time taken for the procedures is standardized. This will affect the input and the output of the study.
2. The structure and space of the ORs have no effect on the productivity and the efficiency that will not affect the utilization report.
3. Personnel flexibility and to help in scheduling and ORs efficiency.
4. The daily huddles play a crucial role in increasing efficiency.
5. Continuous performance monitoring will help to improve productivity.
6. Patient flow influences OR efficiency.
7. Inter-departmental relation have an impact on the process flow of the OR.
8. Resource planning and patient planning have a greater effect on OR efficiency than strategic planning. There is research that states that the OR efficiency depends more on case scheduling and staffing which is managed by the OR staff and head of the departments and is not very much dependent on strategic management.
   1. **DESIGN METHODOLOGY AND DATA COLLECTION**

The study was based on collected OR data from various resources. The data collection was a crucial step in this study. It is the foundation on which the outcomes were based. The following will show the various methods and resources of data collection along with their implications. It is important in a case study that you use multiple methods of data collection. There are various UPMC systems used in this case study for data collection. Some of the data may contain confidential information and thus are replaced by abbreviations or letters for this study. Some of the data collected were on the UPMC computer system, “Cerner”, a health information database which is used across UPMC system to store and record their data and since they are available online, they could not be incorporated in this study. However, the results from those data sets are illustrated in figures in the findings in the later part of the presentation.

**4.1. OPERATING ROOM SCHEDULE**

There is a weekly OR schedule that is released by the schedulers every quarter. The study was started in July 2018. The figure shows OR schedule depicting the service lines and the surgeon’s blocks from that month for the first week.

A screenshot of a cell phone

Description automatically generated

Figure 1: Operating room schedule for the month of July 2018

For the purpose of this study and to maintain confidentiality of the surgeons, surgeons names are replaced by letters. This OR schedule is used to schedule surgeries according to the various service lines. This is the schedule for week 1. Similarly, there are schedules for week 2, 3, 4 and 5. The surgeon whose name is on the schedule above may not be primary operating surgeon as there can be a different surgeon of the same service line operating in that particular OR and that particular surgical block. As seen in Figure 1, there is space for additional cases which can be utilized for any add on cases. The utilization of this add on case time is very crucial in determining OR efficiency. All OR staff have access to this scheduling, and they need to adhere to the schedule as much as possible.

This surgical schedule is also accessed by UPMC’s corporation finance team, who use it as the basis for their analysis of OR efficiency and in preparation of the utilization report. It is very important that any changes made in the schedule of the service lines is reflected on this schedule so that the finance team is aware of the same and they use the revised schedule for the preparation of the reports.

**4.2 UPMC SYSTEM POLICY**

UPMC has a system wide policy that provides guidelines for scheduling surgical cases that must be followed by the schedulers. According to the policy, there should be specific elective blocks as well as urgent or non-blocks intended to accommodate urgent or emergent cases and also to accommodate surgeons who do not have a specific OR block time on a given day. The policy permits the scheduling of elective cases only during times in which appropriate staff and equipment are available to provide the needed care for the patients, elective surgeries should not be scheduled significantly beyond the established duration for a given OR block time, which causes the scheduled block time to be exceeded.

Hospital OR blocks can be released for open scheduling at 9:30 am three working days (72 hours) prior to the assigned block time. The released block is then converted to open time for use by any surgeon on a first- come, first- serve basis. If more than 25% of block time is released in two consecutive quarters, the service line will be notified and that block will be re-evaluated. The UPMC Policy which was used for the data analysis cannot be included in the paper for the purpose of confidentially and copyright.

* 1. **RESULTS/FINDINGS**

The analysis reported that UPMC Mercy OR efficiency was the lowest on Wednesdays. This study reviewed the daily utilization report from July 2018 to December 2018..

Figure 2: General operating room utilization from July 2018 to August 2018.

As seen in Figure 2, the lower utilization is seen on Wednesdays (red) for General operating Room. However, there is a very low utilization seen on the first Thursday. The reason for that is that it was July 5th and the utilization is affected the day after holidays because of many changes in schedules.

Figure 3: General operating room utilization from September 2018 to October 2018.

Figure 4: General operating room utilization from November 2018 to December 2018.

As seen in the Figure 3 and 4, there is lower utilization on Wednesdays (red) for General Operating Room as compared to the other days.

Figure 5: Same day Surgery room utilization from July 2018 to August 2018.

Figure 6: Same day Surgery room utilization from September 2018 to October 2018.

Figure 7: Same day Surgery room utilization from November 2018 to December 2018.

As seen in Figures 5-7, there is lower utilization on Wednesdays (red) for Same Day Surgery as compared to the other days.

Figure 8: General operating room utilization for Wednesdays from July 2018 to December 2018.

As seen in Figure 8, almost all Wednesdays have same range of utilization that is below 70% for General Operating Room.

Figure 9: Same day surgery utilization for Wednesdays from July 2018 to December 2018.

Figure 9 shows that almost all Wednesdays have same range of utilization that is below 70% out of 100% which is the highest for Same Day Surgery.

The overall data indicates that, OR utilization is low on Wednesdays from July 2018 through December 2018 as compared to other days of the week for the general operating room and the same day surgery operating room and hence the focus of the study was to identify the reasons for this lower utilization on Wednesdays.

* 1. **ANALYSIS**

Various reasons were identified that might have contributed to UPMC Mercy’s lower utilization results particularly on Wednesdays. There is no standardization for data collection and data reporting, which is leading to a barrier and hence a lower utilization is seen on the reports. Several people having access to the system data base; they use their own methods for pulling the data, hence there are different reports. These reports reflect different utilization rates than the utilization reports released by the finance team. A major challenge in this study was to find the correct and the relevant data which formed the basis of the utilization report. The anesthesiologists and nurses feed in their own data in the system. There are not designated personnel responsible for pulling the relevant data from the system, that will help in the analysis of the utilization reports. In addition, there are various platforms from which data can be pulled. There needs to be standardized system so that everyone will be on the same page.

Another reason for the lower utilization on Wednesdays was that there is a surgeons’ meeting every Wednesday morning that causes the start time for all cases to be 8 AM instead of 7 AM, the start time for all cases on other days. Due to this meeting, all cases get moved forward by an hour and the cases mostly go beyond 3 PM, which leads to staff overtime. Also, the OR is still staffed from 7 AM until 8 AM on these days which is an unnecessary cost for the hospital. There were also instances when the surgeons start their day between 8:30 AM and 9 AM on Wednesdays due to these meetings.

Another analysis from the above data revealed that many times a new OR was opened for surgeons; these cases could have been performed in the already functional ORs rather than opening a new OR. This causes the new OR to be functional for that case only and to be vacant the rest of the day, thus affecting the utilization reports. Even if the surgery is just for a few hours, the hospital is penalized for the entire day.

* 1. **RECOMMENDATIONS**

As mentioned earlier, UPMC Mercy was founded by the Sisters of Mercy. It has Catholic origins and traditional way of doing things, which may make the hospital somewhat reluctant to adapt to new changes.

One recommendation is to have one person responsible for pulling data from the UPMC system data base. That person should be effectively communicating the information to the finance team as well and should be able to comply the report with the reality happening in the ORs.

Another recommendation would be to have better time management, especially on Wednesdays when there are surgeons’ meetings. OR staff should manage the meeting time effectively and allow the surgeons whose cases start at 7 am to have them start at 7 am without getting it delayed.

UPMC Mercy should change the scheduling of their elective cases and to incorporate these cases into the ORs that are already open but do not have any cases scheduled. They should also avoid scheduling cases that might go beyond 3 pm towards the end of the day.

Surgeons should be incentivized to start their cases on time. That will motivate the surgeons to start promptly and will also help improve the efficiency of the OR along with avoiding unnecessary expenses like cost associated with overtime staffing and the cost associated with running the OR beyond the time. This is one of the toughest recommendations because there are many factors that need to be taken into consideration before implementation. The nurses and the other supporting staff may oppose this. This change would be the last to be implemented due to its difficulty. The surgeons should also be penalized for avoiding overtime by opening a new OR. The OR staff should be responsible to analyze these tradeoffs the surgeons might be undertaking.

* 1. **CONCLUSION**

Increasing OR efficiency is a challenge faced by many hospitals. The objective of this study was to identify barriers in current OR scheduling which was leading to a lower utilization being reflected in the utilization reports at UPMC Mercy hospital. A background study was done to identify some of the best practices adopted by other hospital to improve OR efficiency. Certain assumptions were made to reach the conclusion of this study. The study design and methodology included collecting data from different UPMC resources. An analysis of the results from the collected data revealed lower utilization, especially on Wednesdays; various contributing factors were identified. Certain recommendations were made to improve OR efficiency at UPMC Mercy hospital with a hope to see improvement in the utilization reports.

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UPMC Mercy System Policy