Impact of revised management policies on the efficiency of gynecologic operating room processes in a tertiary training hospital*

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ABSTRACT

Background: A retrospective observational time motion study of elective gynecologic surgeries performed from January 2015 to December 2016 was conducted at the Operating Room Complex of a tertiary training hospital. There was a change from three operating suites with standard last stitch time in 2015 to only two with no cutoff times in 2016. This was due to the renovation of the Operating Room Complex.

Objective: To determine the factors and problems affecting operating room processes

Materials and Methods: Different time motion parameters such as induction time, length of induction, cutting time, last stitch time, total operation time, turnover time, and number of cases performed were collected from the nurses' documentation records. Average values from two different time periods were compared and analyzed.

Results: Results showed no improvement with the revised policies implemented in 2016. With only two rooms, surgeons were able to cope with the number of patients by extending operating hours later through the day. Recurring problems on manpower and lack of resources were noted.

Conclusion: There is a need to identify hindrance to efficient operating room utilization with the goal to decrease patient queue, improve patient as well as staff satisfaction, and increase hospital revenue. Multi-disciplinary changes in practices, processes, and attitudes are timely for improvements in operating room utilization and consequently better patient centric outcomes.

Keywords: Efficiency, Operating room, Time motion study

INTRODUCTION AND SIGNIFICANCE OF THE STUDY

Efficiency is defined as producing a given output with minimum input quantities. In terms of the operating room (OR) system, it refers to utilizing its schedule without overrunning or cancellation of cases. Enhancing the efficiency of the operating rooms has always been a challenging process. Balancing the needs to satisfy surgeons, support staff, and meet patient expectations require both clinical and cost effectiveness. This also entails monitoring by the hospital management to ensure resource supply, guarantee quality care, and maintain sustainability.

The operating room setting requires adequate resources. While it contributes to significant staff workload, it is a major source of hospital revenue. Thus, delays in the operating room can be sources of lost income for the hospital. It may correspondingly lead to patient and doctor frustration. Methods to reduce delays are important to maximize utilization of the operating rooms.

It is timely to evaluate the key factors affecting the operating room processes and change longstanding labor structures and practices hindering productivity and efficiency. This was done using a comparison of time motion parameters such as total number of procedures scheduled and performed, mean induction time, mean cutting time, mean last stitch time, mean length of induction, and mean turnover time. These data were obtained from elective surgeries conducted from January to December 2015 and January to December 2016, during which revised policies were implemented to cater the renovation of operating rooms.

Efficiency of operating rooms depends on various factors. Scheduling of cases, apportionment of staff and surgical needs, preparation and induction of anesthesia, actual surgical process, recovery from anesthesia, turnover time, and other resources are factors which significantly affect use of the operating rooms. Inefficient management can result in case cancellations and long patient waiting lists as in the setting in most of our tertiary

*Third Place, Philippine Obstetrical and Gynecological Society (Foundation), Inc. (POGS) Research Paper Contest, October 25, 2017, 3rd Floor POGS Building, Quezon City

public hospitals. However, in most hospitals, efforts to reduce time have mainly involved purchase of new equipment and provision of additional rooms. Change in labor managerial policies has infrequently been the target of initiatives to improve efficiency.[1]

Overdyk *et al*. (1998) accomplished significant improvements in operating room efficiency by analyzing data on causes of delays. They developed strategies for minimizing the most common causes of delay. Personal accountability, streamlining of procedures, interdisciplinary teamwork, and accurate data collection were all-important contributors to improved efficiency. They concluded that changes in practices, processes, and attitudes are likewise needed to bring about improvements in OR utilization.[2]

Efficient operating room systems have the ability to increase the number of cases that can be completed within a block of allocated time without incurring overtime costs.[3,4] Heiser (2013) suggested that a governance structure led by an executive committee be instituted to improve operating room dynamics. An operating room director, chairpersons from different surgical fields, and a representative from hospital administration should comprise this executive committee. They will be in-charge with growing surgical services by marketing the surgical program, ensuring that patient and surgeon needs are met, increasing operating room revenue, and developing the surgical strategic plans.[5]

Delays to Start Time

In a single-center prospective observational study, Porta et al. (2013) found that the average OR delay was 17.3 minutes depending on the surgical service. These authors identified that delays were attributed to turnover time, nurses and surgeon issues, and patient flow issues.[6] An observational study by Higgins et al. (2011) determined that OR delays were related to unforeseen problems on patient condition and preparation prior to surgery. Surgeon and anesthesiologist tardiness also contributes to delays.[7,8] The former causes cases to be cancelled, which significantly impacts OR schedule and utilization rates. The latter delays the case, which directly impacts the start time of the case that follows, cause cancellations to cases scheduled later in the day, and lead to overtime costs due to the extension of the workday.[8]

Delays that are not within staff control cannot be avoided; but those that are within staff control must be addressed to improve OR efficiency. Does et al. (2009) found that the most important factors in delays to start times were poor planning and scheduling. Poor planning was related to a vague process in which patients were prepared for surgery, such as poor instructions regarding the time the patient is expected to arrive in the pre-operative area, time anesthesia should be available, and time for premedication.[9]

Operating Room Turnover Time

Operating room turnover time (TOT) can be defined in different ways. Meredith et al. (2011) defined turnover time from the last stitch of a patient to the incision of the next patient, specifically all activities excluding the actual surgery.[10,11]

Delays in TOT can be impacted by equipment availability, availability of staff to turn over the room, or readiness of the next patient.[11] Meredith et al. (2011) observed that there are three critical phases in TOT: patient removal, patient transition, and operational preparation. The efficiency with which each of these phases is completed contributes to the improvement of TOT. White space, which is time with no surgical activity occurring, contributes to inefficiency and waste. Examples of white space include instrument preparation and positioning of the patient as well as waiting for surgical staff or the patient. The availability of surgeons in the OR suite also impacted TOT as surgeons were observed to motivate and assist staff with duties other than surgery.[10,12]

The Hospital Setting

Elective procedures are scheduled on weekdays. There are two blocked time schedules for procedures. On Mondays, Tuesdays, Wednesdays, and Fridays, induction time is set at 6:30 AM with a cutting time of 7:00 AM **(early cutting)**. On Thursdays, induction time is 9:00 AM while cutting time is at 9:30 AM **(late cutting)**. This allowed for both anesthesiologist and surgeon to attend their respective department meetings and conferences on said days.

In 2015, there were three operating rooms dedicated for gynecologic cases. One was used for laparoscopic procedures performed by the Reproductive Endocrinology and Infertility (REI) service, and two were used by the General Services, Urogynecology, and Gynecologic Oncology. On the average, three cases were scheduled for each room for a total of nine procedures per day. The number of cases actually performed depends on whether cases were finished before the last stitch time designated at 11:45 AM. If cases extended beyond this time, the next cases will not be allowed to proceed. In 2016, the operating room management policies were revised to cater for the renovation of the Left Central Block (LCB) Complex. Only two rooms were provided for gynecologic cases, to be shared by all the services. To increase patient load, there were no cut-off times for cases. All scheduled cases were allowed to proceed regardless of the time of day. Whether or not these changes led to better operating room efficiency remains undetermined.

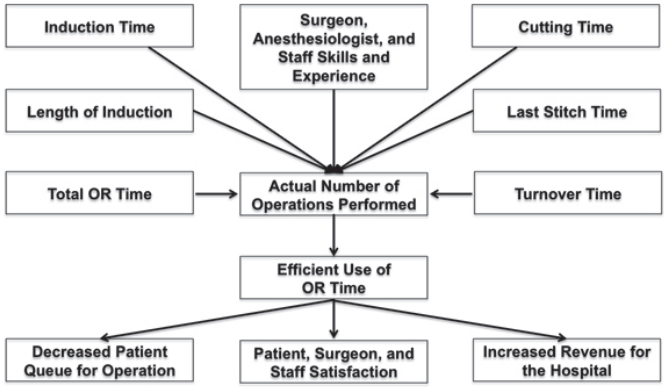

Figure 1. Conceptual framework of the study. The number of cases actually performed daily depends on different factors including the induction time, length of induction, cutting time, last stitch time, total operation time, and turnover time. It likewise depends on the surgeon, anesthesiologist, and staff skills. It measures the efficiency of the operating room system with the ultimate goals to reduce patient queue for operation, satisfy patient, staff, and surgeon, and increase the hospital revenue.

In this study, factors affecting the maximum utilization of operating room suites were evaluated using different time motion parameters as described.

OBJECTIVES OF THE STUDY

General Objective:

To determine the factors and problems affecting operating room processes

Specific Objectives:

1) To determine the efficiency of the operating rooms by analysis of the following data: total number of procedures scheduled and performed, mean induction time, mean cutting time, mean last stitch time, mean length of induction, and mean turnover time for two time periods
2) To determine causes of delay in procedures
3) To compare efficiency of the operating room for two different periods (January to December 2015 and January to December 2016) using the obtained data on operating room processes

MATERIALS AND METHODS

A. STUDY DESIGN

The study is a retrospective observational study.

B. OPERATIONAL DEFINITION OF TERMS

1. Efficiency is defined as producing a given output with minimum input quantities. In the operating room, the use of time is key to the efficient production of surgical cases. An aim of efficiency studies is to minimize time waste or to maximize timesaving. Therefore, this study defines OR process efficiency as maximizing output in terms of actual number of operations performed daily.
2. Induction time is the time anesthesia induction starts.
3. Length of induction is the duration of anesthesia induction. It is computed by subtracting the induction time from cutting time.
4. Cutting time is the time the surgery starts when the first incision is made.
5. Last stitch time is the time the surgery ends, when the last stitch is made.
6. Turnover time is the time from the last stitch of a patient to the induction of the next patient. It refers to the period when no surgery takes place. During turnover time, the operating room is cleaned and instruments are prepared for the next case.

C. DESCRIPTION OF STUDY PROCEDURES

Data were obtained from the nursing documentation record and time motion tallies of elective surgeries of the Operating Room Complex for the years 2015 and 2016. Data obtained were the total number of procedures scheduled and performed, induction time, cutting time, last stitch time, length of induction, and turnover time. The mean values for each of the parameters were recorded and analyzed. Values for two time periods were then compared. Other parameters noted were reasons for cancellation and delay of cases as indicated in the nurses' logbook.

D. STUDY POPULATION and SAMPLE SIZE

All elective surgeries performed by the Gynecology services were included in the study. Emergency procedures were excluded. Duration of data collected is from January 2015 to December 2016.

E. DATA COLLECTION TOOLS AND ANALYSIS

Data were collected from the nursing documentation record and time motion tally sheets (Appendix A) then organized in an Excel file for analysis. In order to achieve the goal of evaluating an explanatory model of efficiency in OR processes, the mean values of each time motion parameter were obtained and compared to their standard or allowable values for both years

RESULTS

Total number of operations performed

In the year 2015, a total of 1198 elective procedures were performed in 232 days. This is higher compared to the 1158 elective procedures performed in 241 days in the year 2016 (Table 1). There were 429 cases in 2015 that were scheduled but not performed. On the other hand, only 172 cases were deferred in 2016. Common causes of cancellations in 2015 were inability to comply with the cutoff time, after which surgeons were not allowed to perform succeeding cases. Due to this, patients were likely to be included in the OR schedule, sometimes for days, before finally being operated on. In both years, lack of preoperative clearance and poor patient preparation (including lack of blood or change in surgical plan) were noted as reasons for cancellations.

Induction time and length of induction

The average time of induction in 2015 was 7:00 AM and 9:25 AM during early and late cutting, respectively. It was later in 2016 at 7:14 AM and 9:46 AM, respectively. This was approximately 25 to 46 minutes late compared to the expected time of induction of 6:30 AM during early cutting and 9:00 AM during late cutting days. 50.8% of cases were induced 30 minutes after the standard time. The average length of induction was 17 minutes in 2015 and 25 minutes in 2016. (Tables 1 and 2)

Cutting time

The average cutting time in 2015 was 7:30 AM and 9:55 AM during early and late cutting, respectively. It was later in 2016 at 7:36 AM and 10:03 AM, respectively. This was approximately 30 to 36 minutes late compared to the expected cutting time of 7:00 AM during early cutting and 9:30 AM during late cutting days. 23.1% of cases had a cutting time more than 30 minutes after the standard time.

Turnover time

Measured as the time from the last stitch of a patient to the induction of the next patient, the mean turnover times were 34 and 35 minutes for 2015 and 2016, respectively.

Causes of delay

Noted causes of delay were the lack of utility workers and working elevators for patient transfers, tardiness of doctors, inefficient intraoperative referral systems, shortage of operative equipment and materials, and delays in release of supplies from the Pharmacy.

DISCUSSION

Managerial aspects of providing healthcare are increasingly becoming vital to reduce costs and improve income. As a major source of revenue, the economic viability of a hospital demands that operating rooms run efficiently. Managing the operating rooms is particularly

Table 1. Number of Elective Procedures Scheduled and Performed

MONTH	2015			2016		
	Scheduled	Performed	OR Days	Scheduled	Performed	OR Days
January	114	82	17	112	97	20
February	117	88	19	110	90	18
March	143	105	22	111	94	21
April	125	87	19	130	118	20
May	133	100	20	120	109	22
June	148	107	20	116	118	24
July	160	129	22	110	103	20
August	139	107	19	95	75	18
September	158	117	21	105	68	19
October	151	122	22	104	87	21
November	119	84	16	114	101	19
December	120	70	15	103	98	19
TOTAL	**1627**	**1198**	**232**	**1330**	**1158**	**241**

Table 2. Time Motion Parameters for 2015 and 2016 for Early Cutting*

MONTH	2015			2016		
	Induction Time	Cutting Time	Last Stitch Time	Induction Time	Cutting Time	Last Stitch Time
January	6:54 AM	7:38 AM	10:56 AM	7:14 AM	7:46 AM	10:01 AM
February	6:56 AM	7:31 AM	10:43 AM	7:06 AM	7:31 AM	9:50 AM
March	6:54 AM	7:30 AM	10:22 AM	6:59 AM	7:30 AM	10:02 AM
April	6:57 AM	7:36 AM	10:34 AM	6:55 AM	7:31 AM	10:09 AM
May	6:52 AM	7:27 AM	10:21 AM	7:16 AM	7:42 AM	10:18 AM
June	7:03 AM	7:31 AM	10:14 AM	7:15 AM	7:36 AM	9:41 AM
July	7:00 AM	7:39 AM	10:10 AM	7:07 AM	7:34 AM	10:05 AM
August	7:05 AM	7:34: AM	9:57 AM	7:31 AM	7:50 AM	10:15 AM
September	7:06 AM	7:36: AM	9:58 AM	7:21 AM	7:30 AM	10:30 AM
October	7:00 AM	7:15 AM	10:30 AM	7:32: AM	7:40 AM	10:18 AM
November	7:09 AM	7:20 AM	10:40 AM	7:15 AM	7:31 AM	10:43 AM
December	7:07 AM	7:21 AM	10:40 AM	7:17 AM	7:38 AM	10:17 AM
AVERAGE	**7:00 AM**	**7:30 AM**	**10:25 AM**	**7:14 AM**	**7:36 AM**	**10:10 AM**

**Early cutting: Mondays, Tuesdays, Wednesdays, and Fridays. Induction of anesthesia is expected at 6:30 AM and cutting time is at 7:00 AM. Only the first cases were analyzed for comparison of the above time motion parameters.*

Table 3. Time Motion Parameters for 2015 and 2016 for Late Cutting*

MONTH	2015			2016		
	Induction Time	Cutting Time	Last Stitch Time	Induction Time	Cutting Time	Last Stitch Time
January	9:17 AM	9:52 AM	1:30 PM	9:53 AM	10:40 AM	12:23 PM
February	9:14 AM	10:01 AM	3:13 PM	9:41 AM	10:12 AM	12:56 AM
March	9:37 AM	10:26 AM	2:25 PM	9:23 AM	9:58 AM	1:54 PM
April	9:25 AM	9:51 AM	1:15 PM	10:20 AM	10:43 AM	1:19 PM
May	9:19 AM	9:51 AM	12:30 PM	10:18 AM	10:43 AM	1:36 PM
June	9:10 AM	9:3 AM	12:43 AM	10:03 AM	10:32 AM	12:51 AM
July	9:37 AM	10:10 AM	11:55 AM	9:32 AM	9:54 AM	11:25 AM
August	9:51 AM	10:22 AM	1:02 PM	9:51 AM	10:42 AM	12:25 PM
September	9:41 AM	10:06 AM	12:39 AM	9:30 AM	9:42 AM	1:00 PM
October	9:15 AM	9:40 AM	1:27 PM	9:40 AM	9:54 AM	12:30 PM
November	9:19 AM	9:38 AM	12:39 PM	9:31 AM	10:01 AM	1:15 PM
December	9:17 AM	9:31 AM	1:29PM	9:41 AM	7:40 AM	12:55 PM
AVERAGE	**9:25 AM**	**9:55 AM**	**1:13 PM**	**9:46 AM**	**10:03 AM**	**12:52 PM**

**Late cutting: Thursdays. Induction of anesthesia is expected at 9:00 AM and cutting time is at 9:30 AM. Only the first cases were analyzed for comparison of the above time motion parameters.*

problematic due to scarcity of resources and conflicting priorities of the staff and surgeons. There is a need to forestall problems and stress the need for efficiency by development of adequate planning and scheduling processes.

There were less cases performed in 2016 compared to 2015, which may be due to having one less operating room for elective cases. On the other hand, there was a decrease in the number of cancelled cases in 2016 owing to the new management policy of having no cut-off time

for one of the operating rooms. This allowed surgeons to schedule their patients without having to worry about not meeting the last stitch time. This also decreased the number of hospital days patients would have to wait for their procedure. Ultimately, it decreased patient queue and makes utility of the operating room suite to function more hours daily.

It is imperative in a tertiary hospital setting to investigate the causes of delays in the operating room. This has been addressed by the OR management team. Rules on admitting as well as scheduling patients for elective procedures have already been put it place. Compliance to these rules is monitored.

This study illustrated delays in the time of anesthesia induction and surgeon cutting time. The 25 to 46 minute tardiness in induction reflects of the inefficiency of OR utilization. Steps must be undertaken to investigate reasons for these delays, which may include but are not limited to anesthesiologist and surgeon tardiness, problems with patient transfer to the OR, or lack of equipment for OR use. Regarding the length of induction, shorter time periods were spent on anesthesia induction in 2015. This may be attributed to new rules on scheduling longer cases, i.e. malignant cases were scheduled first, in 2016. These cases were more commonly induced with epidural anesthesia rather than spinal because of a projected longer operation time.

There was no significant difference in the turnover time between the two years. This signifies no improvement in staffing and resource management of the hospital. Idle operating rooms means wasted revenue for the hospital due to underutilization of the suite. It is imperative for hospitals to strive to attain decreased turnover times. This may be done by having a process mapping and delegating responsibilities to specific personnel. Different personnel should be dedicated for cleanup and setup for the next patient as well as transporting patients and equipment to and from the operating room. Patients should be brought immediately into the room after completion of the setup. Better communication is also needed between the staff, anesthesiologists, and surgeons. Planning of personnel duty schedules should also be enforced. A postoperative debriefing of the staff may also be helpful.

CONCLUSION

In conclusion, the change in management policies in the year 2016 did not increase the number of procedures performed. In fact, there were more cases done with three operating rooms even with a required last stitch time. Surgeons were able to cope up with demands to increase the number of procedures in 2016 by staying later in the day. Careful selection of patients and strategic planning of schedule to decrease cancellation of cases should be strictly implemented. The induction and cutting time for both years were similar. Both were considerably late from standard allowable times. Efforts should be made to monitor these time parameters to achieve anesthesiologist and surgeon punctuality. Moreover, improvement in turnover time was not apparent with revised policies. This may be improved by setting up an approved systems process, delegation of tasks, and ensuring that manpower and resources are able to keep up with patient queues for operations. The culture in the delivery of care in the OR must change from what is best for the surgeon and nurses to what is best for the hospital and patients.

LIMITATIONS OF THE STUDY

There are several limitations to this study. First, as the data are from a single hospital, the results may be difficult to generalize to other hospitals with different functional characteristics such as size, services provided, and case mix. Variability of case duration also makes it difficult to predict actual utilization. Even for straightforward, common operations, actual case time is uncertain. Each patient is different, and the actual time for a given operation cannot be predicted. This fact means that in a series of cases that are scheduled to follow, the actual start time of cases after the first case cannot be determined in advance. Likewise, surgeon and nursing staff skills and experience affect the actual operating time.

RECOMMENDATIONS

The investigators will present the findings of the study to the operating room management team. As discussed, there is a need for a structured and timely monitoring of the different time motion parameters. Monthly or quarterly evaluations may be needed for prompt mediation. Interventions may be discussed during meetings with immediate reassessment of operating room efficiency. Further studies may be done after revision of policies and implementation of strict rules adherence to operating room standard times. ■

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