

Factors Affecting the Main Operation Room Utilization Time at King Abdullah Medical City

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Abstract Background: Hospitals and operating room departments aim to improve quality and safety, as well as utilization and efficiency. Operating rooms are cost-intensive, multi professional parts of health care organizations. Thus, efficient usage of OR capacity is crucial. **Aim of the study:** The aim of the current study is to determine the factors affecting the main operation room utilization time at King Abdullah Medical City (KAMC). **Subjects and Methods:** A retrospective descriptive research design was utilized to achieve the aim of the study. Four hundred forty-eight days included in this study with no missing data. Data was collected from the operations registration office and the quality department at KAMC in Saudi Arabia in terms of data inventory and reliability and was analyzed by statistical package for social sciences (SPSS) version 24. **Results:** 94.2% of ICU beds post-operative were available. Also, 77.9 % of surgeon' attendance on time and 75.5% of the first cases started on time. Highly statistical significant difference between 2017 and 2018 in relation to predictor factors of operation room utilization time was found. **Conclusion:** Availability of intensive care unit beds, starting the first case start on time and surgeon' attendance on time are the predictor factors for operating room utilization time. **Recommendations:** Ministry of health should work as much as possible to provide enough intensive care beds for operation theatre. Also, surgeons should attend to work at operation room at the right time and they should start working with the first case at the right time. The staff should be motivated by different incentives to start the operation on time.

Keywords: operation room, utilization time

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1. Introduction

Nowadays, abundant changes in hospital financing require concurrent efforts to increase efficiency throughout entire organizations; operating theaters (OTs) require thorough planning to streamline management of highly complex and expensive processes, all the measures must be taken to make it highly efficient [1]. Multidisciplinary approaches improve operating room (OR) efficiency and reduces the cancellation. Specialty based time distribution and their underutilization affects and if it can be predicted then it also improves the working of the OR [2].

Operating room as an important area of hospital activity requires maximum utilization to ensure optimum cost benefit. In any hospital OR is said to be the source of primary revenue generation with around 50%–60% of revenue generated only with this area. To achieve a high level of time utilization in the OR, it is necessary to efficiently coordinate several activities and personnel, it is, therefore, desirable to optimize the efficiency of OR [3]. It has been shown that timeliness of operating room planning

processes and adherence to scheduled times are crucial for efficient time utilization within large centralized OR units. Determining factors include variation of start times, case durations, and room turnover times [4].

More importantly, unanticipated cancellation of scheduled operations at the last minute, even on the morning of surgery is of concern. Late cancellation of scheduled operations is a major cause of inefficient use of operating room time and a waste of resources. It is also potentially stressful with depressing effects and costly to the patient in terms of working days lost and disruption of daily life [5].

A late start of the first surgical case of the day is a common source of frustration for patients, management, and the surgical team. Once a case is delayed, a typical "trickle down" effect causes the delay to increase as the day progresses, potentially affecting the rest of the scheduled patients. This might result in cases finishing late and over-utilization of OR time. Patient satisfaction may be reduced if cases are delayed beyond their scheduled start times, particularly if patients who had to fast are kept waiting for several hours [6].

Utilization is a simple and adequate measure of the efficiency of a theater, because of its ability to generate

revenue rises as the time for which it is used increases. Utilization of the OR time has always been a priority area for hospital administrators. One study showed that the utilization of OR time was 72.51% which was found to be optimum, and most of the scheduled hours were utilized for elective surgeries and unscheduled hours for emergency surgeries [7].

In a similar study conducted in Saudi Arabia, showed that 47% improvement in elective OR utilization and OR utilization reaching 69%, and 18% improvement in pre/post-op process time [2]. More importantly, studies concerning with OR utilization time in Saudi Arabia especially in KAMC are lacking, also the factors which affect the utilization of time in OR were not considered in Saudi Arabia, ignoring these factors might lead to aggravating of the of OR time poor utilization, the issue which might decrease the efficiency of OR and hospital management as well as Saudi health care system.

The KAMC has 7 rooms in main OR department, there are a lot of and crowded surgical cases which may impede the flow of cases in a regular manner, these ORs are in need to be improved, in terms of time utilization process, studies concerning this issue are lacking in the KAMC.

2. Significance of the Research

An excellent management is needed to satisfy patients, fulfill demands of surgeons and operation theater staff and to proof a well-functioning operation theater. operation theater needs a great amount of resource to maintain a working function in any hospital. It is essential that operation theatre time should be well utilized and managed to increase the surgical management in any hospital. Proper functioning of operation theater depends on a good hospital management, provision of multiple medical and surgical services such as equipment, drugs, time utilization, sterilization, and control of infections [8,9].

2.1. Aims of the Study

The main aim of the current study is to determine the factors affecting the main OR utilization time at King Abdullah Medical City.

3. Research Methodology

A retrospective descriptive research design was utilized to achieve the aim of the study. Data required for this study was obtained from KAMC in Saudi Arabia which has been issued by the operations registration office and from the quality department in KAMC in terms of data inventory and in terms of reliability. Data which has been collected concerning the times and that has been used in the specialties such as: specialized surgeries, nerve surgeries, heart surgeries and tumor surgeries for elective cases in the year 2017 and 2018. For the purpose of this study, factors affecting the main operation room utilization time at KAMC have been defined in this study as: the availability of intensive care unit (ICU) beds for post-operations, first case starts on time, and the mean time of arrival of the surgeon to the OR. Comparison for

the preceded three parameters were done between the year 2017 and 2018.

OT start time was calculated as when the case inside the OT room (wheel in); any delay more than 10 min of the scheduled start time was noted down. Anesthesia time was calculated as the time when anesthesiologist attaches the first monitor to the patient to the time when the patient is handed over to the surgeons for scrubbing; any delay more than 15 min, the reason was specified.

4. Ethical Considerations

The researcher was committed to all ethical considerations required to conduct a research. In addition, ethical approval was obtained from institutional review board to carry out the study.

5. Statistical Techniques

Data was analyzed by statistical package for social sciences (SPSS) version 24. Descriptive statistics including frequencies and percentages were used to summarize the cases included in this study, number and percentage of the availability of ICU beds for post-operations, first case starts on time, and the mean time of arrival of the surgeon to the OR as well as ideal time and non-ideal time distribution. Chi-square test was used to compare the differences in these factors between the year 2017 and 2018.

6. Results

Table 1 demonstrates Comparison between 2017 and 2018 in relation to optimal time to perform the operations. Highly statistical significant difference was found between 2017 and 2018 in relation to optimal time to perform the operations, $p=0.000$.

Table 1. Comparison between 2017 and 2018 in relation to optimal time to perform the operations (n=448)

Operation time	2017		2018		Total	Sig.
	No	%	No	%		
Yes	5	2.1	99	47.6	104 (23.2%)	X ² =129.5 P=0.000
No	235	97.9	109	52.4	344 (76.8%)	

X²: Chi-square Test, significant at P <0.05.

Table 2 illustrates comparison between 2017 and 2018 in relation to availability of intensive care unit beds. There was highly statistical significant difference between 2017 and 2018 in relation to availability of intensive care unit beds, $p=0.000$.

Table 2. Comparison between 2017 and 2018 in relation to availability of intensive care unit beds (n=448)

Availability of intensive care unit beds	2017		2018		Total	Sig.
	No	%	No	%		
Yes	137	57.1	196	94.2	333 (74.3%)	X ² =80.6 P=0.000
No	103	42.9	12	5.8	115 (25.7%)	

X²: Chi-square Test, significant at P <0.05.

Table 3 showed comparison between 2017 and 2018 in relation to optimal time to surgeon's attendance at the right time. It was observed that 77.9 % of surgeon attend at the right time in 2018. Highly statistical significant difference between 2017 and 2018 in relation to optimal time to surgeon's attendance at the right time was found, $p=0.000$.

Table 3. Comparison between 2017 and 2018 in relation to optimal time to surgeon's attendance at the right time (n=448)

Surgeon' attendance at the right time	2017		2018		Total	Sig.
	No	%	No	%		
Yes	118	49.2	162	77.9	280 (62.5%)	X ² =39.2 P=0.000*
No	122	50.8	46	22.1	168 (37.5%)	

X²: Chi-square Test, significant at P <0.05.

Table 4 illustrates comparison between 2017 and 2018 in relation to starting the first case on time. It was noted that 75.5% of the cases started on time in 2018. It was also observed that there was highly statistical significant difference between 2017 and 2018 in relation to starting the first case on time, $p=0.000$.

Table 4. Comparison between 2017 and 2018 in relation to starting the first case on time (n=448)

Starting the first case on time	2017		2018		Total	Sig.
	No	%	No	%		
Yes	73	30.4	157	75.5	230 (51.3%)	X ² =90.6 P=0.000*
No	167	69.6	51	24.5	218 (48.7%)	

X²: Chi-square Test, significant at P <0.05.

Table 5 showed the Factors affecting utilization of the main operation room by logistic regression. The results of logistic regression produced a biologically sound model, and the results showed that the variable availability of intensive care beds post operations was the first variable which affects significantly the performance of operations regarding the ideal time; as the regression coefficient for this variable reached (1.63), meaning that the availability of intensive care beds post operations will lead to an increase in the percentage of operations performance in the optimal time by (1.63).

Table 5. Factors affecting utilization of the main operation room by logistic regression

Factor	Beta	SD	p-value	Regression coefficient
Availability of beds post operation	1.63	0,49	0.001	0.20
Surgeon' attendance on time	0.48	0.37	0.002	0.62
First case starts on time	0.97	0.35	0.006	0.38
Constant	0.39	0.15	0.006	0,67
Factor	Beta	SD	p-value	Regression coefficients
Availability of beds post operation	1.63	0,49	0.001	0.20

In addition, the variable First case start on time was the second variable which affects significantly the performance of operations regarding the ideal time, as the regression coefficient for this variable reached (0.97); meaning that, in the case of beginning the first case at the

right time, will lead to an increase in the percentage of performing operations in an ideal time by (0.97).

On the other hand, the variable surgeon' attendance on time was the third variable which affects significantly the performance of operations regarding the ideal time, as the regression coefficient for this variable reached (0.48), meaning that if the surgeon attended on time, this would increase the percentage of operations' performing in an ideal time by (0.48).

7. Discussion

Operating rooms are of paramount importance to a hospital, given the fact that more than 60% of patients admitted to a hospital are treated in the OR [10]. The current study demonstrated that the availability of intensive care beds post operations was the first variable which affects significantly the performance of operations regarding the ideal time. This result is matched with Phieffer et al 2017 [11] who informed that ICU unavailability caused delay for the first patient scheduled for major surgery requiring postsurgical ICU. In a study by Garg et al 2009 [12] reported that cancellations were reported on the day of surgery due to ICU unavailability.

It was also noted that First case start on time was the second variable which affects significantly the performance of operations regarding the ideal time. This result is in line with Collar et al 2012 [13] who reported that first case on-time starts associated with the reduction in idle-OR time as well as improved patient and provider satisfaction.

Starting on time is one of many parameters used to evaluate efficiency of the operating room. The current study results indicated that surgeon' attendance on time was the third variable which affects significantly the performance of operations regarding the ideal time, this result is matched with Wright et al 2010 [6] who stated that starting on time is one aspect of an efficient operating room.

Findings of the current study indicated that there was Highly statistical significant difference was found between 2017 and 2018 in relation to optimal time to perform the operations. The number of operations started on time increased in 2018 than 2017. This may be related to attendance of surgeon and anesthesiologist on time. This result is matches with Wright et al 2010 [6] who reported that through a staged, multidisciplinary, multifaceted approach, we were able to increase the percentage of operations that began on time from 6% to 60% in the operating room of an academic pediatric hospital.

The present study Findings revealed that there was highly statistical significant difference between 2017 and 2018 in relation to starting the first case on time. 75.5% of the first cases started on time. This may be related to ICU availability, patients being prepared and reaching the operating on time, good planning quality and anesthesiologist, surgeon ' attendance on time. This result in line with Fezza 2011 [14] who reported that the percentage of first procedure on-time starts increased from 31% in August 2009 to 43% in September 2009 and In June 2010, the percentage had increased to 80%. van Veen et al 2014 [15] also reported that the increased percentage

of first cases starting at least 5 min too late was caused by the fact that 1 anesthesiologist covers 2 ORs simultaneously.

8. Conclusion

Factors which affect the utilization of ideal time in operation theatres include availability of intensive care beds post operations, first case start on time, and surgeon's attendance on time. Working to provide intensive care beds in proportion to the number of daily operations, starting the first case on time, and surgeon's attendance at the right time are considered significant factors related to utilization of ideal time in operation rooms.

9. Recommendations

Ministry of health should work as much as possible to provide enough intensive care beds for operation theatre. Also, surgeons should attend to work at operation room at the right time and they should start working with the first case at the right time. The staff should be motivated by different incentives to start the operation on time. proper communication among surgeon, anesthesiologist, and nursing staff to provide improve operating room time utilization.

Conflicts of Interest

None.

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