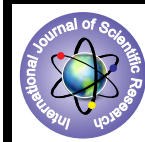


## Open Scheduling Vs. Block Scheduling – a Study in a Tertiary Care Teaching Hospital, Hyderabad



### Medical Science

**KEYWORDS :** Health care, Operation Theatre, Utilization, Scheduling, Planning.

<b>Dr. N. Lakshmi Bhaskar</b>	Assistant Professor, Department of Hospital Administration, Nizam's Institute of Medical Sciences
<b>Dr. S. Naga Satish Kumar</b>	Resident, Department of Hospital Administration, Nizam's Institute of Medical Sciences
<b>Dr.P. Rakesh Prabhu</b>	Resident, Department of Hospital Administration, Nizam's Institute of Medical Sciences
<b>Dr.K.T. Reddy</b>	Additional Professor, Department of Hospital Administration, Nizam's Institute of Medical Sciences

### ABSTRACT

*Scheduling is a very common problem in managing effective utilization of Operation Theatres. Many studies have been done to find the best schedule which is able to meet the patient's satisfaction and minimize the total cost of the operating theatre. The present study is aimed to understand the difference in utilization of operation theatre due to open or blocked scheduling carried out in two OTs of Nizam's Institute of Medical Sciences, Hyderabad, India, from August 2011 to November 2011. It was observed that the utilization of OT-3 (79%) is almost near to average utilization of all theatres (72%), where as there is marked decrease in utilization of IDOT (46%) with p-value less than 0.0001, inferring that there was difference in utilization of both the theatres which had different type of scheduling.*

### INTRODUCTION:

Managing the Operating Theatre (OT), however, is hard due to the conflicting priorities and the preferences of its stakeholders,<sup>1</sup> but also due to the scarcity of costly resources. Moreover, health managers have to anticipate the increasing demand for surgical services caused by the aging population.<sup>2</sup> These factors clearly stress the need for efficiency and necessitate the development of adequate planning and scheduling procedures.

Scheduling procedures in hospitals often present difficulties due to a wide range of variables such as doctor availability, doctor preference, operating hours, and functionality of rooms. Their main goal is to meet the patient's satisfaction by minimizing total waiting time before undergoing operations. Another objective is to minimize the costs involved with OT such as staffing cost, or also known as overtime cost, which is greater than that of regular working hours. This has led to the need of optimizing the availability of the operating theatre by minimizing the under-allocation of each operation room. With many moving parts and many factors to consider, creating an optimal surgical schedule is not an easy task. Having an optimal, or close to optimal, surgical schedule can improve the efficiency in the hospital by helping to reduce hospital and patient costs, to reduce patient waiting time and to increase the utilization of the operating rooms. Several recent researches have focused on both the objectives of minimizing the overtime cost and maximizing the utilization of OT.

In the past 60 years, a large body of literature on the management of OT has evolved. Magerlein and Martin<sup>3</sup> review the literature on surgical demand scheduling and distinguish between advance scheduling and allocation scheduling. Advance scheduling is the process of fixing a surgery date for a patient, whereas allocation scheduling determines the operating room and the starting time of the procedure on the specific day of surgery. Scheduling of OT can be divided into several types of strategies which are open scheduling, block scheduling and modified block scheduling.<sup>4</sup> In the open scheduling policy, no pre allocation is used, patients are scheduled without any specialty related restriction.<sup>5, 6</sup> Whereas, for block scheduling, specific surgeons or groups of surgeons are assigned a set of time blocks, normally for some weeks or months, into which they can arrange their surgi-

cal cases.<sup>4</sup> Modified block scheduling is modified into two ways to increase its flexibility. Either some time is blocked and some is left open, or unused block time is released at an agreed-upon time before surgery.<sup>6</sup> Choice among type of scheduling is based on the complexities of the real situation in the hospitals.

The present study is carried out among the OTs of Nizam's Institute of Medical Sciences (NIMS), Hyderabad, India; a 1200 bedded tertiary care teaching hospital rendering super-specialty services among various medical and surgical specialties. The institute operates through five operation theatre complexes, four of which (OT-1, OT-2, OT-3 and IDOT) are scheduled for mostly elective surgical cases and one theatre for emergency services. Scheduling of cases for OT-1, OT-2 and OT-3 is blocked type whereas it is open type for IDOT. A previous study on utilization of OTs by the author showed marked difference in utilization of OT-3 (82.47%) and IDOT (48.98%), which had different type of scheduling.<sup>7</sup> The present study is aimed to understand the difference in utilization of operation theatre due to open or blocked scheduling.

### METHODOLOGY:

A retrospective study design was adopted was to understand difference in utilization of OTs due to scheduling for the time period of August, 2011 to November, 2011. IDOT with open scheduling and OT 3 with blocked scheduling were selected for the study. The data regarding number of surgeries done per table was collected along with the time consumed for each surgery from records maintained at OTs and was analyzed for utilization of OTs and utilization indices were calculated. Research hypothesis was formulated that "There is difference in utilization of operation theatres due to open scheduling or closed scheduling." Student t-test was applied with p-value less than 0.05 to reject the null hypothesis using GraphPad software.

### RESULTS:

**Table 1: Utilization of OT-3 and IDOT complexes:**

	Scheduled Surgeries			Unscheduled Surgeries			Total		
	Elective (hrs)	Emergency (hrs)	Total (hrs)	Elective (hrs)	Emergency (hrs)	Total (hrs)	Elective (hrs)	Emergency (hrs)	Total (hrs)
OT-3	119108 (84.90%)	7195 (5.09%)	146990	8190 (60.86%)	5525 (39.14%)	14115	148090 (91.92%)	13020 (9.08%)	161110
IDOT	41575 (100%)	0	41575	3055 (100%)	0	3055	44650 (100%)	0	44650

**Table 1: Efficiency of OT-3 and IDOT complexes:**

	Allotted time (hrs)	Utilized time(hrs)	Efficiency
OT-3	1860000	161110	79.03%
IDOT	90480	44630	45.95%

Utilization of OT-3 for the time period was around 79%. List of surgeries posted for the theatre was decided one day before and the table were scheduled and dedicated to particular surgical departments. The departments decide and submit the list one day prior to the anaesthetist. Since it was blocked scheduling, scheduled time was completely planned for surgeries. Most of the time was utilized for scheduled elective surgeries. Unscheduled time was also mostly utilized for elective cases.

Utilization of IDOT for the time period was around 46%. The OT tables were not allotted to any department, since scheduling was based on open scheduling. Various departments requiring table will block or book the table, if their dedicated tables in other theatres were not sufficient to handle the cases for that day with the permission of anaesthetist. It was the decision of anaesthetist to grant the permission to post the case. It can be noted that most of the OT time utilized was during scheduled hours only. Since, it was scheduled prior, only elective surgeries were done in the theatre.

The utilization of both the theatres was compared statistically using student t-test. The computed p value was less than 0.0001, which is extremely statistically significant rejecting null hypothesis. It affirms that there is difference of utilization in both the theatres.

**DISCUSSION:**

Scheduling is very common problem in managing operating rooms for government and private hospitals. Many studies have been done to find the best schedule which is able to meet the patient’s satisfaction and minimize the total cost of the operating theatre.

It can be grossly observed that the utilization of OT 3 (79%) is almost near to average utilization of all theatres (72%), where as there is marked decrease in utilization of IDOT (46%) for the time period. Theatres with blocked scheduling are scheduled first, as these tables were dedicated to the departments. These theatres scheduling of surgeries was observed to be planned at the time of admissions of patients. It was observed that, the process of scheduling starts a week prior tentatively, though the final list was submitted only one day prior to the theatre. If there were more admissions or there were cases which consume more of OT time, where the dedicated tables cannot accommodate all the cases, to avoid pooling up of pre operative cases in the wards, IDOT will be utilized for posting such cases. This resulted in posting of comparatively little number of cases. Moreover the theatre hours was utilized for elective surgeries only. The reason can be explained, as most of the emergencies were preferably done in their dedicated tables during unscheduled hours easily. Moreover if a case needs to be operated in emergency, the emergency case was posted in regular tables in place of elective surgery, which was either postponed or scheduled in IDOT. It can be understood that the tables of IDOT was more or less utilized to buffer the dedicated OT tables of the departments.

Stringent rules from the department of anaesthesia to post a surgical case on a table, was also observed as one of the reasons for less scheduling of IDOT. These few reasons can be ascertained to open scheduling of theatre, which resulted in less utilization of the theatre. The present study statistically confirms that there difference in utilization of both the theatres, which can be attributed to nature of scheduling from the above reasons.

One of the major problems associated with the development of accurate operating room schedules is uncertainly inherent to surgical services. Whereas deterministic planning and scheduling approaches ignore such uncertainty or variability, stochastic approaches try to incorporate it. In a study,<sup>8</sup> scheduling was planned based on some fields, i.e. Patient characteristics as elective or emergency; Performance measures such as waiting time, patient deferral, utilization, financial value, preferences or throughput; Decision level indicating what type of decision has to be made (date, time, room or capacity) and whether this decision is situated on the discipline, the surgeon or the patient level; Type of analysis distinguishing between an optimization problem, a decision problem, a scenario analysis, a data envelopment analysis or a complexity analysis; and Solution technique such as mathematical programming methods, constructive and improvement heuristics, simulation or analytical approaches.

The literature on operating room planning and scheduling exhibits a wide range of solution methodologies that are retrieved from the domains of operations management and operations research. Gass and Harris,<sup>9</sup> Winston and Goldberg<sup>10</sup> studies gave a brief introduction to the various solution techniques like mathematical programming solutions based on linear programming, quadratic programming, goal programming, mixed integer programming, dynamic programming, etc; simulation programming solutions like discrete-event and Monte-Carlo; constructive heuristic solution; improvement heuristic solutions like meta-heuristic simulated annealing, tabu search, genetic algorithm; etc. Implementation of different types of operating theatre scheduling is based on the complexities of the real situation in the hospitals.

**CONCLUSION:**

Utilization of OT 3 (79%) is almost near to average utilization of all theatres (72%), where as there is marked decrease in utilization of IDOT (46%) for the time period inferring that scheduling affects utilization of OTs. A lot of researches done can help to determine an approach to scheduling of theatres appropriate for a hospital setting.

**REFERENCE**

1. S. Glaberman and H. Mintzberg. Managing the care of health and the cure of disease - Part I: Differentiation. *Health Care Management Review*, 26:56(69), 2001. | 2. D.A. Etzioni, J.H. Liu, M.A. Maggard, and C.Y. Ko. The aging population and its impact on the surgery workforce. *Annals of Surgery*, 238 (2):170(177), 2003. | 3. J.M. Magerlein and J.B. Martin. Surgical demand scheduling: A review. *Health Services Research*, 13:418(433), 1978. | 4. Fei, H.; Meskens, N. and Chu, C. (2006). An operating theatre planning and scheduling problem in the case of a "block scheduling" strategy. In IEEE ICSSSM'06 (International conference on service systems and service management) (pp. 422- 428). Troyes, France. | 5. Fei, H.; Meskens, N. and Chu, C. (2010). A planning and scheduling problem for an operating theatre using an open scheduling strategy. *Journal of Computer & Industrial Engineering*, 58: 221-230. | 6. Liu, Y., Chu, C., & Wang, K. (2011). A new heuristic algorithm for the operating room scheduling problem. *Computers & Industrial Engineering*, doi:10.1016/j.cie.2011.05.020. | 7. Dr. N. Lakshmi Bhaskar, Dr. S. Naga Satish Kumar, Dr. N. Satyanarayana A Study of Utilization of Operation Theatres in a Tertiary Care Teaching Hospital, Hyderabad *Indian Journal of Applied Research*, Vol.5, Issue : 4 April 2015. | 8. Brecht Cardoen, Erik Demeulemeester and Jeroen Beliën. *Operating room planning and scheduling: A literature review*. Published by Department Of Decision Sciences And Information Management (KBI), 2007 | 9. S.I. Gass and C.M. Harris. *Encyclopedia of operations research and management science*. Kluwer Academic Publishers, 2000. | 10. W.L. Winston and J.B. Goldberg. *Operations research: Applications and algorithms*. Duxbury Press, 2004.