Internship Training

At

Primus Super Speciality Hospital

A Study on O.T Utilization

By

Dr. Amrita Rastogi

Under the guidance of

Dr. B.S Singh

Post Graduate Diploma in Hospital and Health Management

Year 2012-2014

International Institute of Health Management Research

New Delhi

Primus
Super Speciality
Hospital

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The Certificate is awarded to

Dr. Amrita Rastogi

In recognition of having successfully completed her

Internship in the department of

Operations

and has successfully completed her Project on

"A Study on O.T Utilization"

From **1st February 2014** till **30th April 2014**

In

Primus Super Speciality Hospital, Chanakyapuri, New Delhi-21

She comes across as a committed, sincere & diligent person who has a strong drive & zeal for learning

We wish her all the best for future endeavors

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TO WHOMSOEVER MAY CONCERN

This is to certify that Dr. Ameeta Rastogi student of Post Graduate Diploma in Hospital and Health Management (PGDHM) from International Institute of Health Management Research, New Delhi has undergone internship training at Reliance Super Specialty Hospital from 1st Feb to 30th April 2014

The Candidate has successfully carried out the study designated to her during internship training and her approach to the study has been sincere, scientific and analytical.

The Internship is in fulfillment of the course requirements. I wish her all success in all his future endeavors.

Dr. A.K. Agarwal
Dean, Academics and Student Affairs
IIHMR, New Delhi

Dr. B.S Singh
IIHMR, New Delhi

Certificate Of Approval

The following dissertation titled **"A Study on O.T Utilization** at **Primus Super Specialty Hospital** is hereby approved as a certified study in management carried out and presented in a manner satisfactorily to warrant its acceptance as a prerequisite for the award of **Post Graduate Diploma in Health and Hospital Management** for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the dissertation only for the purpose it is submitted.

Dissertation Examination Committee for evaluation of dissertation.

Name	Signature
1) Dr. S. R. Chauhan.	8.5.19
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3) Dr. B.S. Singh.	BSSingh

Certificate from Dissertation Advisory Committee

This is to certify that **Dr. Amrita Rastogi,** a graduate student of the **Post- Graduate Diploma in Health and Hospital Management** has worked under our guidance and supervision. She is submitting this dissertation titled " Study on O.T Utilization" at "Primus Super Speciality Hospital" in partial fulfillment of the requirements for the award of the **Post- Graduate Diploma in Health and Hospital Management.**

This dissertation has the requisite standard and to the best of our knowledge no part of it has been reproduced from any other dissertation, monograph, report or book.

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CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled" A Study on O.T Utilization" and submitted by Dr. Amrita Rastogi Enrollment No PG/12/008 under the supervision of Dr. B.S.Singh for award of Postgraduate Diploma in Hospital and Health Management of the Institute carried out during the period from 1st Feb to 30th April 2014 embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other Institute or other similar institution of higher learning.

Amrita

Dr. Amrita Rastogi
PG/12/008

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NABH

FEEDBACK FORM

NAME OF THE STUDENT	:	DR. Amrita Rastogi
DISSERTATION ORGANIZATION	:	Primus Super Speciality Hospital
AREA OF DISSERTATION	:	Hospital Operations
ATTENDANCE	:	97%
OBJECTIVES ACHIEVED	:	All objectives met successfully
DELIVERABLES	:	Helped organization to improve workflows, system reform system preparedness, implementation of NABH, monitoring standards of working practice, gap analysis within departments & generating statistical information for decision making.
STRENGTHS	:	Goal oriented, hard working, keen observer & good analysis of the problem.
SUGGESTIONS FOR IMPROVEMENT	:	Need to focus on strategic management to reform the system.

Dr. Sudhir Verma
Medical Superintendent
Primus Super Speciality Hospital

Emergency No.: 6620 6620

Orthopaedic | Neuro & Spine | Trauma Centre | ENT & Cochlear Implant | IVF | Dental | Internal Medicine | Nephrology & Kidney Transplant | Gastro & Hepatobiliary Sciences | General & Laparoscopic Surgery | Bariatric Surgery | Physiotherapy

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ABSTRACT

A study was carried out in Primus Super Specialty Hospital with objective of assessment of operation room time utilization analysis and identification of bottlenecks, if any for optimum utilization. It is essential to assess the existing workload as well as to optimize facility functioning and patient scheduling for surgical operations. The operation time utilization varies in different healthcare settings. Optimum utilization of the OT time has always been a priority area for hospitals. It also aids in allocating reserve time for emergency operations, asepsis measures and procedures, and provides decision making information for augmentation or downsizing of the facility. The study was conducted in operation theatre department of the hospital. A sample size of 416 was taken and was selected by convenience sampling method. Primary data was collected and was analysed with the help of Microsoft Office Excel 2007. The study revealed that although the hospital had four operation theatres and well developed hospital management information system the hospital was facing delays in the scheduled surgeries. The study identified the main bottlenecks and was conducted to evaluate the reasons for delay and how to overcome them. Simultaneously the utilisation rate of the operating room was calculated so that running cost could be saved since operating rooms are cost intensive and hospital profit margins could be improved.

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The most awaited moment of successful completion of an endeavour is always a result of individuals involved explicitly or implicitly therein and it is almost impossible without the help, gratitude and guidance of people around. Apart from the personal efforts and steadfastness in work, constant inspiration and encouragement given by number of individuals in this esteemed organisation served as the driving force that enabled me to submit my dissertation report timely in the present format.

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ABBREVIATIONS

C.S.S.D	Central Sterile Supply Department
H.D.U	High Dependency Unit
H.E.P.A	High Efficiency Particulate Air
I.C.U	Intensive Care Unit
O.P.D	Outpatient Department
O.T	Operation Theatre
O.R	Operating Room
PACU	Post anesthetic care unit
S.S.I	Surgical Site Infection
U.P.S	Uninterrupted Power Supply

ORGANIZATION PROFILE

Primus
Super Speciality
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Primus Super Speciality Hospital

Primus Super Specialty Hospital is a state of the art multi specialty hospital conveniently located in the heart of India's capital, New Delhi. The hospital has been designed and constructed using the most advanced medical technology, available in the world. The hospital is located in serene diplomatic area of Chanakyapuri. The infrastructure of the hospital and the quiet environment are conducive to faster recovery, health and well being.

Having Capacity of 250 beds, with prominent surgeons from across the globe excellent infrastructure and state of art advanced technology, Primus Super Speciality Hospital has set new benchmarks in Medical care. We strive to become the best place for treatment of all Medical problems.

The trust and hope patients place in primus hospital says a lot about the people of primus hospital. It also says a lot about the expectations we need to live up to each time a patient comes through our doors.

Primus staff members continuously work to improve the quality of our care, improve our systems, and improve the service we provide. The outstanding staffs at primus hospital have been and continue to be the hallmark for this organization. The hospital stands by the motto of health to all and is committed towards every social cause and up liftmen of country.

Primus Super Speciality Hospital

Vision

To establish a network of world class centres in healthcare by providing state of the art facility and creation of ethical, compassionate patient care through professional excellence.

Mission

Our primary measure of success will be delivering a benchmark quality of medical Services.

Our Organization will be run by responsive, caring and efficient people with a never-ending focus on service and medical excellence.

Quality Policy

Primus is committed to provide ethical, reliable, high quality and cost effective health care services through care and compassion to ensure complete patient satisfaction. We continuously strive to improve the quality of our health care services by:

- Adopting latest technology and equipments to strengthen medical processes and procedures to achieve the set objectives.
- Induction of regular training programs for staff.
- To meet the National and International Standards.

Infrastructure at Primus

The hospital complies with international guidelines and follows the International Patient Service Protocols. The infection control norms will ensure the highest standards of healthcare and patient safety. Our aim is to bring the best of Medical practices worldwide to India and deliver them in an open, warm and patient centric atmosphere.

Modular seamless operation theatres

- OT's with laminar air flow and laminar shields
- 1.5 Tesla MRI
- 64 slice spiral and cardiac CT scan
- Bone densitometry
- VIP suits
- ICU/CCU backup
- Dialysis
- Mammography

Primus Team

Our team of highly skilled professionals is geared up to make the best use of technology and infrastructure, so as to deliver world-class healthcare. Our joint replacement division is headed by Prof. Surya Bhan, an international name in the field of joint replacement surgery. He has been former head of the department of Orthopedics at AIIMS, New Delhi. He has performed many joint replacements so far including complex revision joint replacements, unicondylar knee replacements, minimally invasive hip and knee replacement. Padma Bhushan Dr. C.S. Ranawat is our International faculty and visits Primus for surgeries & consultations. The joint replacement unit has all the necessary

expertise and equipment to deal with complicated problems and to use the latest available implant systems like metal on metal and ceramic on ceramic bearing. The computer aided navigation technology is fully functional to accurately perform these procedures in complicated cases.

SERVICES

ORTHO JOINT REPLACEMENT	GENERAL SURGEON LAPROSCOPIC
ORTHOPAEDIC & TRAUMA	BARIATERIC SURGEON
ENT	SPINE SURGERY
JOINT REPLACEMENT	PSYCIATRIST
UROLOGY	DERMATOLOGY
ARTHROSCOPY & SPORTS MEDICINE	COSMETIC SURGERY
IVF & REPRODUCTIVE MEDICINE	OPTHALMOLOGY
CARDIOLOGY	GAESTROENTROLOGY
GYNAECOLOGY	DENTAL
PHYSICIAN INTERNAL MEDICINE	PHSIOTHERAPY
NEUROLOGY	NEPHROLOGY
PAEDIATRIC	NEURO SURGERY
ENDOCRONOLOGY & THYROID	ONCO SURGEON

Spine Surgery

Disc prolapse, Spinal Stenosis and Spondylosis are common painful diseases which can make daily life miserable. Congenital and developmental disorders, scoliosis, fractures, tumours and infections are less common but very distressing spinal diseases. Our

specialized spinal unit uses surgical and deformity correction techniques with use of minimally access techniques, endoscopic surgery, percutaneous vertabroplasty,artificial disc and fusion procedures with modern implants and image guidance methods to facilitate early recovery during short hospital stay.

Sport Injuries

With increase in sports and fitness related exercises, subtle joint injuries especially muscle ruptures, ligament strains and cartilage injuries of ankle, shoulder and knee have become common and permanent joint damage and prolonged pain and inability to pursue sporting activity and exercise programmes occurs if such injuries are missed, not cared for and inadequately treated. Modern orthopaedics puts great emphasis on recognition and treatment of these difficult to assess joint damage. Experienced orthopaedic surgeons with training in sport injuries are ready to take care of your problems at our hospital.

Arthroscopic Surgery

Arthroscopic or Keyhole surgery of knee and shoulder joints to decompress painful degenerated joint, stabilize recurrent shoulder dislocation, repair cartilage, and ligament tears has become new global standard of care. These modern techniques allow day care surgery in majority of cases while giving long lasting and permanent relief of symptoms and even allow resumption of sporting activities in many instances. Full range of arthroscopic surgery with modern and latest equipment and materials is provided by our experienced arthroscopic surgeons.

Fractures & Traumatology

Fractures are becoming more complex, multiple and complicated with increase in accidents on and off the roads and in industries. Now a day's large number of newer implants of biocompatible steel and titanium, variety of nails and plates, locking plates and minimally invasive operative techniques with use of image guidance using

fluoroscopy are available. Fractures involving joint surface are technically demanding for adequate management and often arthroscopic assisted surgery is required for proper treatment. Such methods of treatment of fractures ensure complete and rapid recovery and early return to work and independence in daily activities. Our experienced trauma surgeons will use these advanced techniques in fully equipped operation theatres to mend fracture bones.

Hand Surgery

Hand surgery which includes treatment of fractures, crush injuries, arthritic joints, paralytic conditions, has become an important speciality. Hand affections need expert care and rehabilitation methods to restore hand function and this is not yet generally available in many centres. Our hospital has internationally trained hand surgeons who use all the modern effective methods to achieve best possible recovery from hand injuries and disorders in shortest possible time.

Diagnostic Pathology

The department of Laboratory Medicine is open 24 hrs. a day every day of the year. It is a high tech lab that has fully automated instruments which are directly interfaced with the hospital information System and Laboratory Information System.

The Laboratory comprises of departments for Biochemistry, Haematology, Serology, Microbiology, Electrophoresis, Histopathology, Cytology and Clinical Pathology.

Paediatric Orthopaedics

Children can suffer from some very complex congenital and developmental bone and joint diseases like club foot, congenital hip dislocation, osteochondritis and growth disturbance of bones. Children's fractures are also unique since growth disturbance can occur with inadequate treatment. Treatment of these problems requires dedicated experienced surgeons and rehabilitation team to achieve best possible prompt and

complete recovery to allow normal growth and milestones of children. Hospital has such expert surgeons and support persons to take care of all bone and joint diseases of growing children.

Radiology Department

Radiology Department is functional round the clock with following modern equipments

64 Slice CT

1.5 Tesla MRI

High Resolution Ultrasound

Mammography

Bone Densitometry

Digital X-Ray

Out-Patient Department (OPD)

Part of the hospital with allotted physical & medical facilities in sufficient amount, with regularly scheduled hours to provide care to patients who are not registered as inpatients. First point of contact of the hospital with the patient, acts as a shop window. Links to progressive patient care and helps in health promotion and disease prevention.

Emergency services

At PRIMUS Super Speciality Hospital, emergency handling has been exclusively programmed to avoid wastage of time. Separate entrance for emergency patients, outpatients and inpatients avoids crowd and resultant confusion. The "24 hours PRIMUS Emergency Services" includes fully equipped Resuscitation Room with ventilators, central venous catheters, defibrillators, Radiology Department equipped to handle all emergencies, special ICU with four world class operation theatres with the most modern equipment.

The moment an accident or trauma patient arrives, he/she is rushed to the Resuscitation Room. Once the patient is stabilized, he/she is taken to the adjacent wash room for removal of all traces of dirt and infection and subsequently brought back to the Resuscitation Room for examination, diagnosis and treatment. Depending on the degree of injury sustained, action is taken without any loss of time. A patient with minor injuries is moved to the suture room; once that requires careful monitoring is moved to the ICU and those in need of critical surgeries are shifted to the fully equipped Emergency Operation Theatre for immediate treatment.

Intensive Care Unit (ICU)

PRIMUS boasts of 18 bedded fully equipped ICU with each bed having advanced invasive and non-invasive monitoring with a six bedded HDU (high dependency unit) attached to ICU. The ICU has the facility of central monitoring situated at nurses work station.

The ICU is equipped with advanced ventilators (Nellcor Puritan Bennett) to Ventilate critically ill patients (adult as well as paediatric patients), Defibrillators, Central

oxygen supply, central suction, resuscitation equipments, motorized multiposition beds, air mattresses (to prevent bed sores in bed ridden patients), bedside echocardiography and life saving and emergency drugs.

The ICU is looked after by a qualified and dedicated team of anaesthesiologists and intesivists who provide round the clock care to the patients with a human touch. Team of specialists support includes cardiologists, nephrologists, urologist, neurologist and neurosurgeon present on call, should the need arise. World class nursing care is provided by a team of well qualified and trained nurses and other paramedical staff.

Wards / room

PRIMUS is certified for its hospital services thereby assuring you world class facility during your period of stay at the hospital. If solitude is bliss to a healthy human being, it is an inevitable necessity for an ailing patient. PRIMUS has taken great care in designing each room with keeping in mind the space and privacy which every patient longs for when away from home. Extreme attention has been paid towards the training of the staff to provide compassionate and sympathetic care for each patient.

Complete interiors and facilities for every room in this 150 bedded hospital have been designed without any distinction of class so that patients from every walk of life share the same comforts.

The deluxe rooms are replete with all facilities like TV, Telephone, Internet, refrigerator, newspapers and magazines. Adequate forethought has ensured that apart from the facilities available within the room, commensurate ease is experienced in reaching out to medical help if the situation so demands. Hence, each floor has a desk staffed by trained, dedicated nurses, attendants and full-time doctors.

The food and beverage department takes utmost care in scheduling your diet which has been designed by our expert nutritionist of dietetics department. The hospital is meticulously cleaned frequently throughout the day and hence eliminating any chances of infection.

Diagnostic Pathology

The department of Laboratory Medicine is open 24 hrs. a day every day of the year. It is a high tech lab that has fully automated instruments which are directly interfaced with the hospital information System and Laboratory Information System.

The Laboratory comprises of departments for Biochemistry, Haematology, Serology,

Microbiology, Electrophoresis, Histopathology, Cytology and Clinical Pathology.

Diagnostics

Primus laid a great emphasis on the 3 following factors before installation of each and every piece of equipment for the diagnostic centre.

- The latest state of the art equipment which could facilitate finest diagnostic details.
- Minimize any radiations exposure both to the patient as well as the technical staff involved.
- Provide instant analysis of the results with complete time efficiency.

X-ray unit

The Heliophos D/KLH (1 tube)/FV 3000 x-ray unit provides the best image quality of digital images with rich contrast. BV Libra 9", mobile e-arm provides outstanding image quality at lowest possible dose. It has two monitors for image processing, review, archiving and display. Multimedia Mobile Siemens portable x-ray machine which facilitates easy accessibility in case of emergencies. CR view with dry view camera.

Siemens Somatom Emotion 64 Slice Configuration CT scans

It vividly allows cutting edge medical technology with minimal life cycle cost. This equipment can reliably perform routine and advanced application like CT colonography, long range vascular CT, and ECG gated imaging of the heart. The machine carries finest diagnostic details, with the fastest speed and maximum efficiency with lowest patient exposure. CT angiography facilitates evaluation of spiral images and display of vessels, vascular anomalies, aneurysms plaques and stenosis.

EMG/NCV Lab

Medtronic key point workstation modular 4 channel upgradeable system for clinical nerve conduction study/EMG and evoked potentials is based on latest software and hardware technology which enables to work online and collaborate with colleagues, other department and hospital. The additional feature includes online comparison of measured values against normative data. Outstanding single fibre EMGF and macro programs designed to provide both statistical and graphic analysis of captured neurophysiologic signals.

Nerve conduction Study

Nerve conduction study with F-wave and inching.

Multimode nerve conduction.

Decrement test

H-reflex

Blink reflex

Area increment

Electromyography

Quantitative EMG, including multiple multi-channel EMG oscilloscopes

Single fibre EMG

Macro EMG

Interval studies

Sympathetic skin response

Evoked Potentials

Somatosensory Evoked Potentials

Auditory Evoked Potentials

Visual Evoked Potentials

Cognitive Evoked Potentials

Prodigy Advance Densitometer

High performance latest fan beam technology, DEXA, digital densitometer with total body for diagnosis and monitoring of osteoporosis. Features with automated encore software with enhanced imager resolution operating on windows-XP platform, multiview image reconstruction, comparison to previous scan, fracture risk assessment, scoliotic spine analysis.

INTRODUCTION

OPERATION THEATRE

An operating theatre, also known as an operating theatre, operating room (OR) or operating suite, is a facility within a hospital where surgical operations are carried out in a sterile environment. Historically, the term "operating theatre" referred to a non-sterile, tiered theatre or amphitheatre in which students and other spectators could watch surgeons perform surgery.

An Operation Theatre is that specialized facility of the hospital where life saving or life improving procedures are carried out on the human body by invasive methods under strict aseptic conditions in a controlled environment by specially trained personnel to promote healing and cure with maximum safety, comfort and economy.

Primus Super speciality hospital has 4 state of the art Operating Rooms on the first floor, all equipped with specialized electrically operated tables, operating lights and anaesthesia machines. The OT complex is built as per international standards with central supply and laminar air-flow, stainless steel cladding on walls and epoxy coating on the floor for electro static and infection free environment. The complex also has Pre-Op Room, store Room, doctor's room and change rooms for doctors and nursing staff.

Ergonomics of the operation rooms:

- The O.T's are modular, hermetically sealed, seamless having sloping walls. The doors are hand operated which run on nylon wheels for smooth and effortless sliding and each door is having a 300 x 300 mm viewing window.
- Both walls and ceiling are made up of zinc passivated galvanized iron, sprayed with 400 micron thick antibacterial paint which does not allow bacteria to grow for
- a period of 7 – 10 years.

- Each theatre has washable antistatic and conductive flooring which is resistant to mechanical stress and dynamic loads.
- Each theatre with air exhaust outlets is provided with HEPA filters and a central plain air covered with hand woven perforated polyester sheet. All combined together give the air flow a laminar pattern with 20 air changes per hour of fresh air to minimize Surgical Site Infection (SSI).
- The ceiling mounted laminar flow friendly operating lights emit white and shadow less light.
- Each O.T. has operating tables that offer maximum flexibility in their use for doing a variety of surgeries.
- Tile based membrane type control panel are in place flushed with theatre wall have: day time and lapse time clock, dimmer for plain air and peripheral lights, telephone, medical gases status alarm and indicators for temperature and humidity.
- Twin plate X-Ray viewing box flushed with the wall are in place in every O.T.
- There are 3 stainless steel scrub sinks with photo electric sensors.
- All theatres are provided with continuous central supply for oxygen, nitrous oxide, high and low pressure air at required flow and pressures.
- Uninterrupted electricity supply through UPS is ensured in the theatres.
- The spacious pre operative areas are fitted with modern monitors, ventilators and crash carts for continuous monitoring and management of the patients along with other paraphernalia for continuous observation of patients.
- Special precautions for infection control are being taken by regular microbiological surveillance of O.Ts and CSSD.

OPERATION THEATRE OBJECTIVES:

- To provide skilled and efficient administration of anaesthesia, for elective & emergency operations throughout the year.
- Training of all doctors, O.T technician & O.T sister.
- Safe and effective sterilization and fumigation protocols.
- Improving coordination among the surgeons & the surgical team.
- Having control on the stock available in the O.T, by assigning the work to different people & verifying them in regular intervals.
- Standardization of surgeries done in the operation theatre, speciality wise .
- Streamlining of various processes related to implant procurement, billing & consumables.
- Ensure maximum utilization of the O.T
- Ensure maximum safety to patients and staff working in the O.T

CRITERIA FOR PLANNING:

- Environmental criteria: Provide complete environmental control for safety of patients as well as the staff working in O.T
- Economic criteria: Optimization of the inter relationship between various financial areas and operating departments.
- Work flow criteria: The flow of patients, staff and supplies in operating department to be well planned.
- Functional criteria: Design must follow functional requirements.

EQUIPMENTS:

The O.Ts are equipped with state-of–the-art equipment like C-arms, operating microscopes, anaesthesia machines, A.O Drill, Laparoscopic system, Harmonics etc.

FACTORS AFFECTING UTILIZATION OF EQUIPMENT:

Medical equipments are expensive to procure and maintain. There are various factors, which must be considered for their optimal utilization.

Training of the staff:

Timely and appropriate training of the staff handling and operating the equipment is a prerequisite for effective and optimum utilization of equipment.

Equipment installed on turnkey basis:

It has been observed that costly equipment planning on turnkey basis have better utilization, as equipment planning considerations factors like civil, electrical, air-conditioning installation etc are ensured by the firm. Thus the equipment, when handed over to the hospital is fully functional. Prior to the commissioning of the facility, adequate number of personnel should already be trained by the firm installing the equipment.

Preventive maintenance and after sales services:

Insisting on the regular sales services of the equipment and proper system of preventive maintenance, the down time of essential equipments can be considerably reduced, thereby increasing utilization. Normally the annual maintenance cost of equipment varies from 5-10% of the capital cost of the equipment. By ensuring availability of repairs, maintenance of spares and necessary spares, equipment utilization can be significantly increased. It must also be ensured to keep adequate essential spares handy in case of sudden breakdowns.

Facility for back-up power supply:

As most of the vital and essential equipment are functioning on electricity or chargeable battery supply, facility for back-up power supply should be ensured. Some arrangement has to be made in the form of standby generator or if possible uninstructed power supply (UPS) units.

Time Scheduling of the hospital:

Hospital timing should be scheduled in such a way that there is optimum utilization of the costly equipment. Usually in hospitals, the facilities work only for 8 hours (8am-4pm) which amounts to 66% of utilization, even if the facilities are available for 50-60% of their capacity.

Use Co-efficient:

Use Co-efficient is applied to assess the utilization of equipment is optimally utilized or underutilized. Use Co-efficient of equipment may be measured by the following formula.

Use co-efficient % = (N/M)*100 where N is average no. of hours the equipment is used per day. Where M is maximum number of hours the equipment can be used per day.

If the use co-efficient is less than 50%, it is considered to be underutilized and hence a bad investment. However, life saving equipment cannot be subjected to this kind of assessment.

Awareness of the facility:

It is that the existing and prospective clientele is aware of the medical facilities available in a health care institution.

. **Upgradeability:**

Most of the modern equipment is functional on micro processor technology. It is imperative to buy the latest model. On introduction of a new model if feasible, it should be upgraded rather than discarded. Equipment based on modular technology should be upgraded by addition of modules.

Preventive maintenance:

Preventive maintenance is another popular concept in maintenance management. This form of maintenance is a planned maintenance program for the equipment resulting in periodic inspection and check-up. It has to be carried out routinely and before the need arises for repairs that would eventually interrupt the system service and could also prove expensive. Most of the times, preventive maintenance can be carried out by the user independent of the engineer

WORKFLOW

Operation Theatre Booking: O.T List is finalized a day before.

Preparation for surgery: Sterilized instruments and linen collected and arranged in respective O.Ts. All O.T's checked for the readiness of the surgery.

Shifting of patient from ward to O.T: Ward nurse informed, Patient called half an hour before operation time

Patient received in pre operative area.

Patient is shifted to O.T on trolley

Patient reaches to operating room

Patient is anaesthetized

Patient surgical area is cleaned and draped, surgery conducted.

Patient out of operating room, shifted to PACU.

Patient shifted to ward.

Prepare O.T for next surgery.

Operation theatre Booking

- O.T List is finalized the day before at 4 pm.
- O.Ts allotted for anesthesia consultants, checking and signing the O.T list.
- O.T list photocopied and distributed to all wards and residents on duty.
- Original O.T list at O.T reception.

Preparation for surgery

Sterilized instruments and linen collected and arranged in respective O.Ts from TSSU on previous night.

All O.T's checked for the readiness of the surgery.

- Anesthesia trolley checked and drugs drawn up.
- Anesthesia machines, ventilators, central gas supply and cylinders checked.
- All sutures needed for surgery listed and taken from O.T pharmacy.
- List entered into register with date, patient I.D, surgery type and signed.
- Unused sutures return to O.T pharmacy, cancelled from pharmacy register and final billing done on pharmacy online billing system.
- Drugs needed for surgery are listed out by O.T technician.
- Entry made in O.T pharmacy register with date, patient I.D, surgery type and signed.
- Unused drugs returned to O.T pharmacy, cancelled from pharmacy register and final billing done on pharmacy online billing system.

Shifting patient to O.T

- O.T list is checked for first patients in all O.T s and corresponding room numbers.

- Ward nurse informed of patient shifting 15min before patient is to be shifted.
- Patient called half hour before operation time.
- Patient is shifted from ward to O.T.
- Patient I.D, nature of surgery, pre operative checklist checked and handed over.
- Shifting of critically ill patients from wards / H.D.U. / I.C.U with resuscitation equipments and drugs.

Receiving patients in O.T

- Patient is received in pre operative holding area.
- Patient file and time of patient is received noted in pre operative checklist received.
- Patient file, nature of surgery, vitals and reports reviewed in pre operative area.
- Patient is shifted to O.T on trolley.
- Patient is then transferred on to table and connected to monitors. Before taking the patient to OR staff must explain the patient according to his/her anxiety level whatever he/she want to ask.
- Biomed equipments/consumables/instruments/drugs must kept ready before shifting the patient to operating room.

Intra operative process

- All instruments and assisting nurses ready for surgery.
- '**Sign In**', before induction of anesthesia, verbally confirm with the patient (when possible) his or her identity, the surgical site and the procedure, and that consent to operate has been obtained.
- The coordinator will visually confirm that the operative site has been marked (if appropriate) and will verbally review with the anaesthesia professional the patient's risk of blood loss, airway difficulty and allergies, and also whether a

safety check of the anaesthesia machine and medications has been completed.

- Patient is anaesthetized.
- For **'Time Out'** the team will pause immediately before the skin incision to confirm out aloud that the correct operation on the correct patient and site is being performed; all team members will then verbally review with one another, in turn, the critical elements of their plans for the operation. They will also confirm that prophylactic antibiotics have been administered within the previous 60 minutes and that essential imaging is displayed as appropriate.
- Patient surgical area is cleaned and draped, surgery conducted.
- Blood and Blood products required – Requisition slip filled and sent to Blood Bank.
- **Sign out (before patient leaves the operating room),** nurse verbally confirms about the procedure done. Counting: gauze pieces, sponges, blades, needles and instruments are counted whether complete or not. If equipment or instrument not working properly inform to OR supervisor and biomedical engineer
- Patient vital parameters, fluid intake and output anesthetic gas and drug administration etc monitored.
- Surgery completed, patient awakened from anesthesia.
- Pathology/ other lab specimens collected appropriately labeled, requisition form filled and sent to lab.

PACU care

- Patient shifted out of O.T to HDU.
- Patient attached to monitors, vitals checked and noted, patient made comfortable

any required analgesia prescribed to be given, patient reassured if awake.

- Operation notes completed and post operative instruction list attached and signed and any additions and deletions made.
- Anesthesia chart during surgery completed and signed blood. Blood/Blood products given duly noted including bag number and expiry.
- Decision made to shift patient to ward after ensuring patient is stable, not in pain and comfortable.
- Post operative pain, medication, name frequency and mode of administration entered in case notes and signed.
- Ward nurse informed about patient shifting.
- Patient is shifted to the ward.
- Patient handed over to the ward nurse.

Patient hand over to ward staff:

- Complete file handover to ward staff including OR formats.
- Explain the procedure done in OR and the instruction given by surgeon and anaesthetist (position /NPO status /monitoring /medication /infusion).
- While shifting the patient from or bed to ward bed instructs the staff to take care of catheters and drains as ordered by the surgeon.
- After shifting the patient enter the shifting notes

Preparing O.T for next surgery

- Used instruments are removed, washed and handed back to CSSD in O.T complex for sterilization.
- Dirty linen removed and kept in laundry collection area – sent in lots to laundry.
- Floors, mopped with disinfectant.

- O.T table, suction bottles, cleaned and laryngoscopes disinfected.
- Anesthesia machine cleaned and cleared of used drugs and disposals.

O.T Fumigation protocol

- After an infected case as per 'list of infections in O.T fumigation protocol ', O.T is closed, cleaned and fumigated.
- O.T is fumigated before certain procedures like Renal transplants, joint replacements etc.
- Routine fumigation of O.T suite is done weekly.
- Culture from O.T sent to microbiology laboratory after fumigation (monthly).

Day care surgery

- Patient reports to O.T reception.
- Registered as day case and payment made at the registration counter.
- Sister in charge of O.T is informed about patient arrival.
- Patient is taken to changing room for changing of clothes.
- Taken to the preoperative waiting area and vitals, height, weight taken and pre operative checklist run through.
- Systems and case is reviewed and consent is taken.
- PAC taken and medication reviewed, pre anesthesia administered, if necessary/ relevant.
- Patient taken for surgery into O.T.
- Taken to HDU (PACU) after surgery.
- Patient discharged directly from PACU (HDU).

Emergency surgery

- Patient sources: Ward, I.C.U, ER

- Anesthesia consultant on care informed about need for emergency surgery .
- Availability of O.T checked and surgeons informed.
- Ward sister informed about patient's need for surgery and shifting to O.T and pre operative orders attached to case file.
- Nursing pre operative checklist and doctors orders carried out.
- Care to ward nurse from O.T when theater is ready.
- Patient is shifted to I.C.U directly from O.T

C.S.S.D

The TSSU is situated within O.T complex itself and consist of:-

- ❖ A dirty section with instruments receipts area.
- ❖ Sterilization area
- ❖ Clean section with storage and issue area.

- Used instruments removed , washed in O.T side room and handed back to C.S.S.D.
- Instruments received in C.S.S.D by C.S.S.D technician on duty as per the duty roaster.
- Entry made in C.S.S.D receipts , register including date, time ,washed and not washed/ chemical wash , type of instruments ,procedure used for and case infected or not , name and signature of person handing over and name and signature of person receiving.
- Instruments checked in front of scrub nurse for any damage, missing piece etc with help of instrument stock/ sets register.

- Instrument washed with detergent, sorted, packed, labeled and autoclave. Indicator pasted and put through sterilization process as in TSSU operations protocol.
- Instruments, packs removed from autoclave (sterilization units and arranged on shelf life in clean area.
- Clean instrument pack issued to scrub nurse after entry into issue register.
- Dirty linen picked up in O.T and sent to laundry directly.
- Clean linen sent from laundry to CSSD.
- Clean linen packed as per surgery requirement and autoclaved.
- Linen stored and issued the same way as instrument.
- Operation maintenance and calibration of equipment in CSSD maintained and stock maintenance, purchase indents against condemnation of records maintained.

QUALITY OF SERVICES IN O.T

Quality of services in O.T, like in other department, depends upon three aspects, namely, structure, process and outcome. The structure and process part are completely unknown to the patient or his relatives because they are not present during the procedure. Only way they can judge the quality of O.T services is from quality of outcome.

Quality of outcome:

From patient's point of view the outcome means:

- A surgical procedure that was justified.
- A procedure that was correctly performed, on the correct body part of correct patient by the correct specialist or surgeon using the correct technique.

- The procedure that fulfilled the intended purpose, i.e. the cure of the ailment or the disability.
- The procedure that was safe and hazard free. No complications, no harm to the patient, of any kind during the surgery.
- No post operative sepsis
- Cost that is affordable.

A good quality outcome should be able to meet all the above requirements. However, outcome inturn, depends on the quality of infrastructure available as well as procedure applied in the O.T , unless the infrastructure and the processes are of acceptable standards, the quality of output is unlikely to be of acceptable level.

Quality aspects of structure:

Important quality considerations.

- A high standard of asepsis
- High standard of safety of patient
- High level of functional efficiency and safety of staff.
- High standard of physical facilities, equipment and technology.

In order to satisfy the above considerations, the structure available must meet the accepted norms and standards as discussed below.

1. Physical facilities:

Location: The operation department should be in immediate vicinity/ adjacent to ICU & acute surgical ward. Access or good communication from Radiology, Pathology, CSSD, and Blood Bank is also essential. It should be away from general traffic and well protected from sun, heat, noise, dust and wind.

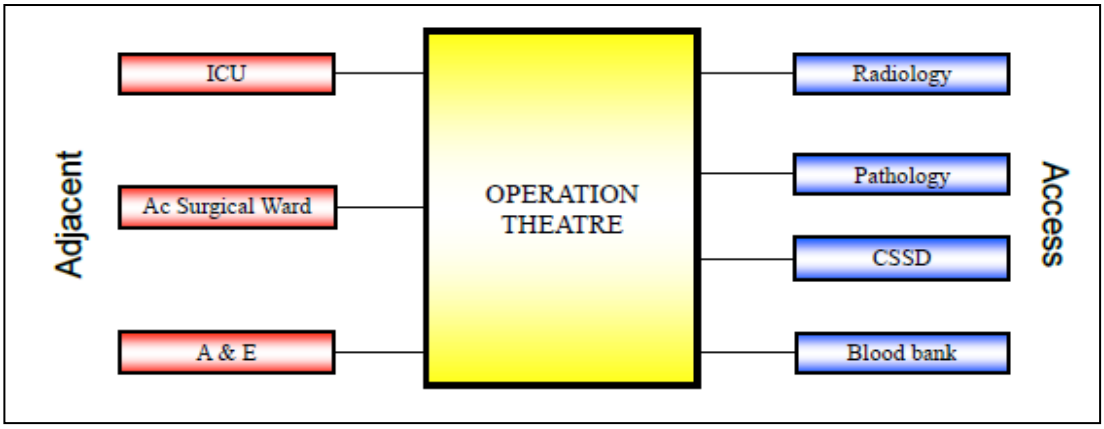

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Fig 1.1 Location of Operation Department

Traffic flow: in operation theatre is of various types and their smooth flow is essential for efficient and effective functioning of the department. The department should be planned in such a way that there is no mixing of dirty and clean traffic. The traffic in operation theatre is of the following types: -

- Staff (Doctors and Nurses)
- Patients
- Supplies (Sterile and Disposal**)**

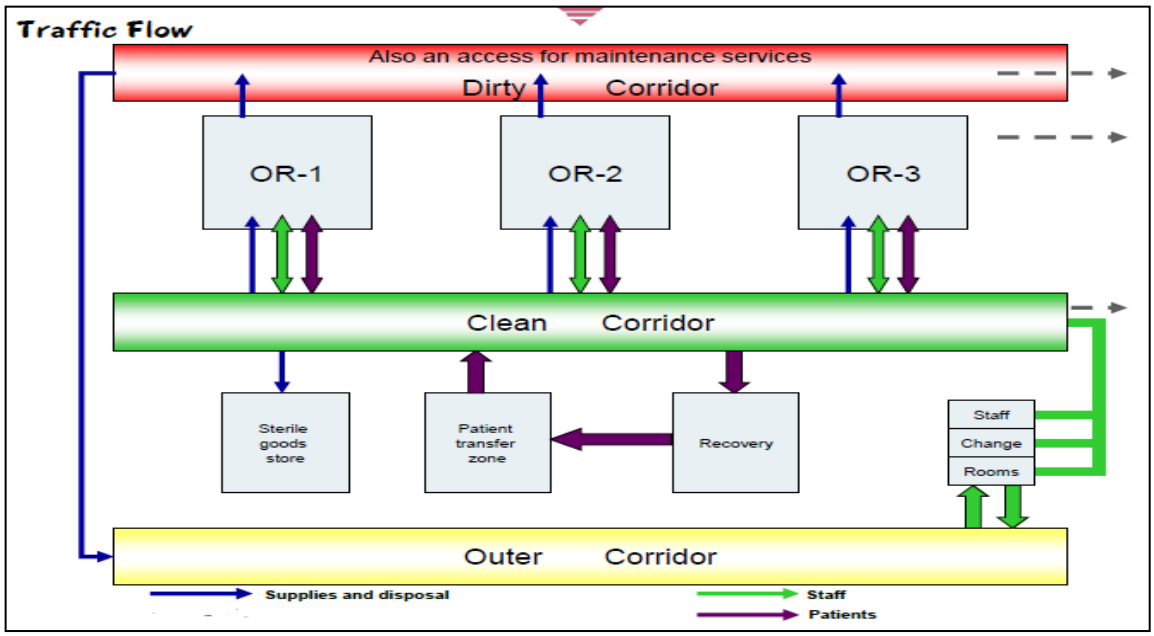

Fig 1.2 Traffic Flow in operation department

The design (building, space, layout , finishes) must follow the functional requirements. The, doors, ceilings, floors should have smooth surfaces which does not allow collection of dust. The flooring should be conductive and the department should have at least two fire escape routes for escape in the event of fire hazard.

- Floor: is recommended to be slip resistant, robust with coved skirting and crack free. Terrazzo, tiles, and sheet are all acceptable but preferably of light color.
- Wall: should have a finish, which is able to stand repeated washings, as well as accidental impact of trolleys. Terrazzo, tiles, and sheet are recommended. The sheet may be of plastic laminate, glass or stainless steel.
- Ceilings: have traditionally been of hard washable surfaces, but to counter noise pollution acoustically absorbent surfaces are now advised.
- Doors and frames: as these are liable to damage from mobile equipment and trolleys, they should be of durable material. Doors should be double leaf, swing type with clear glass vision panel, which must be capable of being obscured for privacy. It should be at least 1.5 m wide and 2.1 m high (to allow portable X-ray machine to pass through).

Space requirement for the operation room : Different authorities have recommended different sizes for the operation room . As per Todd Wheeler, a room size of 16 x 18 F size will satisfy the requirements for most operations. Davies and Macaulay have recommended a 6M X 6M size and Putsep has given 40 to 42 Sq M as a satisfactory size. As per Delhi Govt. Rules O.T should have a minimum floor space 180 Sq F.

Zoning concept: Zoning may be defined as a system of maintaining increasing degree of sterility from outside the OT through various zones of OT up to the site of incision. Through zoning concept following can be achieved:-

- A high degree of asepsis can be achieved by the zoning concept.
- Reduce chance of infection in OT
- Reduces post-op complications
- Enhances post-op recovery and early ambulation
- Reduces patients stay in hospital and enhances the hospital image.
- Zoning follows the principal of increasing sterility from outside through the various zones up to the incision site.

Zone 1	Dirty Zone /Protective	Reception, waiting, trolley bay, change rooms for all staff with conveniences, transfer bay for patient, material & equipments, rooms for administrative staff ,stores & records, sterile stores.
Zone 2	Clean Area – Connects Protective zone to Aseptic zone (OR)	Pre & Post operative rooms, recovery, plaster room, equipment store room, maintenance, workshop, kitchenette (Pantry), fire fighting device room, service room for staff, close circuit TV Control area, and emergency exit.
Zone 3	Sterile Area	Operating room scrub room/ area, anaesthesia room, equipment setup room.
Zone 4	Disposal Area	Dirty utility, disposal corridor.

1.1 Zoning Concept

No	Zone	Description
0	Sterile	Limited to the area of incision
1	Ultra Clean	Determined by a circle with a 1 meter diameter from the wound
2	Super Clean	Scrub up and gowning areas, operation rooms, Operation room stores, sterile linen stores, thoracic post anesthetic rooms.
3	Clean	Surgical department reception ward, anesthetic rooms, delivery rooms, endoscopy rooms, stores

		for blood, medicine, IV fluids, sterile service area, general post anesthetic area, X ray apparatus stores, clean bed stores
4	General	Other areas where the cleanliness corresponds to the usual hospital cleanliness standards

Table 1.2 Zones in O.T

Engineering Services

Stable and uninterrupted supply of power ensured by the mains, the generator supply as well as dedicated UPS system, adequate supply of clean water (hot and cold) , a reliable system of delivery of gases (oxygen, nitrous oxide, compressed air) and vacuum at the desired pressures. The electrical sockets (as also the equipment) should be of vapour proof type and above 5 feet from the ground (in operation rooms where combustible anaesthetic gases are used).

Air conditioning and ventilation

Laminar air flow with 10-20 air exchanges / hour

Up to maximum 80% recirculation of air

Ultraclean Laminar airflow (90% removal of particles >0.5μ)

Temperature 20-24°C (for patient needs)

Positive air pressure in OR

Relative Humidity 50-60%

Positive air pressure to be maintained in the operating room round the clock to avoid outside air to be sucked in due to negative pressure. There should be no recirculation of air on / around the table. Air should be filtered through a series of HEPA filter (High efficiency particulate air) which are inspected regularly.

Lighting in the O.T: General level of illumination in the O.T may be 500 to 2000 lux but the O.T light must be shadowless and should have the intensity of 1,00,000-1,20,000 lux with minimum 4000 lux at the bottom of 13cm deep and 5 cm wide incision at the point of incision.

Staff: Availability of adequate staff (their category wise strength matching the workload, their qualifications, level of training and proficiency in doing their task and handling their equipment) and a designated head of department to ensure smooth and streamlined functioning and implementation of all policies and procedures in the O.T

The quality of equipments and instruments:

The appropriate type (need based), level of sophistication and functional state of equipment available, are extremely important. Equipments such as pulse oximeter, defibrillator, C-arm, laparoscope, etc if available, can add value and quality to the services. Adequate fir fighting equipment should be available.

Consumables: Availability of high quality consumable if available such as sutures, drugs, bandages, disinfectants etc has to be ensured.

The quality of each and every one of these structural elements has a direct (or indirect) effect on the process of surgery and its outcome and therefore a lot of in-depth study and analysis of the requirements must go into the planning of infrastructure in the operation theatre.

QUALITY CONTROL OF PROCESS

For functional efficiency and high quality outcome it is essential that the process should ensure the following:-

Availability of quality manual containing policies and procedures governing various aspects of functioning of O.T as well as written protocols for all processes as follows:

- Reception and preoperative supervision of patients.
- A documented protocol for prevention of wrong patient/ wrong site/ wrong surgery. It should include verification of patient's identity , marking of correct operative site and of the operative procedures to be performed, by the anaesthetists, the operating surgeon and the O.T nurse, before the preoperative cleaning and draping of patient on the basis of the following:
    - Clinical examination of the patient.
    - Medical records and radiological images/ x rays.
    - Operative site marked
    - Pre operative notes of the surgeon in charge
    - Pre operative nurses evaluation notes
    - Informed consent.
- Pre operative examination of patient by the anaesthetist to ensure that the patient has had a PA checks up and he is fit to undergo anaesthesia.
- Administration of anaesthesia, intubation, positioning of the patient.
- Staff changing to O.T dress, cap and mask.
- Scrubbing, gowning, and putting on the gloves and aprons.
- Procedure for preoperative cleaning/ disinfection of the operative site.
- Laying out, checking, rechecking and counting the instruments, sponges etc.
- Collection and counting of used instruments, linen and materials.

- A procedure for sending the tissues for histopathology studies to the laboratory.
- Monitoring and management of post operative cases in the recovery ward. Transfer out of recovery should be after reassessment by the anaesthetist on the basis of defined criteria.
- The condition of patient and the instructions for further management must be recorded in the case record before transfer.
- A protocol for safe transfer of patient to and fro from the O.T along with the suitable staff.
- A protocol for informed consent before surgery
- A policy and procedure that no illegal procedure is carried out in O.T and all procedures are carried out as per ethical/ legal norms.
- A policy and procedure to ensure anaesthesia is administered by the staff duly accredited, privileged and permitted by the hospital management.
- A procedure to ensure that only the staff duly credentialed, privileged and permitted by the hospital authorities is allowed to operate on the patients.
- A documented procedure for infection control in the O.T including the procedure for disinfection, of equipments and periodic fumigation of operation rooms, swabs for culture and strict observance of zoning concept to be followed.
- A documented policy and protocol strictly implemented in the event of needle stick injury/ splash of blood/ body fluids and for reporting such incidents.
- Disposal of biomedical waste.
- A policy and protocol for operating upon the cases known to be HIV / hepatitis positive.
- The dress code may be defined and strictly implemented in the O.T. Garments made of wool, silk or synthetic materials may not be allowed in the operation

rooms and all staff should be provided with slippers. No one should be allowed in the sterile zone without changing into O.T dress.

- A strictly implemented and documented policy to regulate the entry of patients, relatives/visitors in the pre operative room and other areas of O.T.
- A system of communication with the O.T staff from outside the O.T through call bell/ intercom so that the unauthorized/ unnecessary entry in the O.T can be avoided and the sanctity of O.T can be maintained.
- A procedure for posting of cases and scheduling of surgery.
- A procedure for scheduling of duties of anaesthetists, nurses, technicians, so as to ensure that the emergency surgeries are not delayed because of their non availability.
- A documented and strictly followed policy of punctuality in adherence to the O.T schedule is extremely important so that inconvenience to the patient can be avoided. Maintenance of discipline in the O.T is essential for smooth and efficient functioning of the department.
- A procedure to be followed in case of death of a patient in O.T.
- A protocol for ensuring safety of patients by identifying all the hazards especially fire hazard and implementing the preventive measures including training of staff.
- All electrical equipments in the O.T should have proper earthing which should be tested as per laid down procedures and a regular schedule. A record of same should be maintained.
- A program of planned preventive maintenance / recalibration of all the equipments/ instruments and maintenance of records there of.
- Periodic check of functioning of instruments and repairs/ condemnation / replacement of those beyond repairs.

- A procedure for indenting and accounting of medical and other stores and forwarding he item wise bill in r/o every case to the billing section for charging the patient.
- Training and development of all O.T staff for quality assurance in O.T.
- Since the O.T facility is used by a large number of surgeons of various specialities, maintenance of O.T discipline, effective coordination and efficient scheduling is always a big challenge for the chief of anaesthesia who generally is the Head of O.T department.

All the quality and efficiency related issues can be sorted out through the medium of formal committee called the "O.T Committee" which can meet periodically to discuss various issues.O.T Committee should have representatives from all surgical disciplines and anaesthesia and may be chaired by the Medical Superintendent (MS).

PERIODIC EVALUATION OF QUALITY OF PROCESS

There should be a system of periodic evaluation of effectiveness of quality policies, procedures and protocols on the basis of certain predetermined criteria such as O.T utilization, swab for culture to check the bacteriological growth, post operative infection rate, surgery wise average time taken for different procedures, cases of negligence if any, instances of indiscipline in the O.T. Comparison of actual performance with the acceptable standards would be able to bring out the deviations from the standards. The same can be analysed and corrective measures implemented. Performance can be reviewed again and again until the level reaches the acceptable standards.

DISSERTATION REPORT: "STUDY ON OPERATION THEATER UTILIZATION"

INTRODUCTION

RATIONALE:

OT is that specialized facility of the hospital where life saving or life improving procedures are carried out on the human body under strict aseptic conditions in a controlled environment by specially trained personnel to promote healing and cure with maximum safety, comfort and economy.

Operation theatre (OT) is the heart of a hospital requiring considerable human resources and expenditure from hospital budget. However, OT's are underutilized and lie idle at times. Enhancing the efficiency of operating theatre has been always a challenging process especially in a quick changing healthcare sector with increased patient care complexity. Balancing the needs to satisfy close monitoring of the operating theatre to ensure efficient resource supply, guaranteed quality safe care provided, and maintain fiscal sustainability. Management of operating theatres requires the coordination of human and material resources in such a way that surgery can be performed efficiently, cost effectively, and safely.

Surgical facilities therefore represent a central life saving activity. Its performance is also dramatic and its successes and failures are highly visible. The activities carried out in this department can make or break the reputation of the hospital.

Optimum utilization of the OT time, accurate records, weekly analysis of recorded data, establishment of operating room rules and regulations and strict adherence to and enforcement of approved policies and procedures are essential ingredients for an efficient operating of an operating room.

Operating rooms (ORs) incur high costs and considerable amount of hospitals revenues. Demand for OR and procedural facilities appears to be increasing due to aging population and developments in surgery. The conventional solution has been to build new facilities. Building them and, of course, staffing them adequately is increasingly expensive. By contrast, committing to increase the productivity of existing facilities seems to be a wiser strategy. One of the key methods here is proper OR management and optimizing the whole process or chain of processes involved in the treatment of a patient.

Nowadays, the medical industry is consuming large scale of health care equipments to fulfil a successful hospital management. When the usage is increased, proportionally the depreciation is also increased. At this stage we are in the need of study about the utilization of the instrument used as well. The progress in medical science and its application of modern technology in diagnostics and therapeutic modalities, has improved the quality of life of human beings almost in all fields of medicine.

Operation Theatre department is a very sensitive department where any infrastructural deficiencies or procedural lapses can seriously compromise the safety of patients leading to repercussions as serious loss of lives. It is the hospital's largest cost and revenue centre; it has a major impact on the performance of the hospital as a whole. There was felt need for efficient and adequate planning and scheduling of surgical procedures. The study will help us to suggest the necessary changes for improving the patient care and assess the utilization of operation theatre.

OBJECTIVES OF THE STUDY

Following are the general and specific objectives of the study:-

GENERAL OBJECTIVE: To assess the operation theatre utilization.

SPECIFIC OBJECTIVES:

- To measure the average delay time in start of surgeries in the operating room.
- To analyze the reasons responsible for rescheduling of the operative procedures.
- To suggest measures to reduce the delay time.
- To know the average surgeries per day in different O.T's.
- To assess the existing scheduling process of surgeries in the operating room.
- To measure the average time interval between different operations.
- To assess the utilization of equipments in O.T
- To assess the level of patient satisfaction with respect to O.T services and staff.

REVIEW OF LITERATURE

Operating theatre is a very sensitive department and a complicated one. Many studies endeavored in assessing efficiency of operating theatres and many formulas were structured to guide in concluding or measuring performance. Most of operating theatre studies explored issues related to time management, schedule, utilization and workflow Other studies stressed safety related issues like foreign bodies, surgical counts, time out practices, and others. In addition many discussed the leadership management and the related scope of practices and the important role managers play to streamline performance and confirm adhering to policies and practices.

The managerial aspects of providing health services to patients in hospitals are becoming increasingly important. Hospitals want to reduce costs and improve their financial assets, on the hand, while they want to maximize the level of patient satisfaction, on the other hand. One unit that is of particular interest is the operating theatre. Since this facility is the hospital's largest cost and revenue centre. Exploring literature guided me to the different concepts that were studied and allowed me to discover the varied strategies utilized to enhance efficiency.

Operating Theatre scheduling is a major contributing factor to enhance the efficiency of operating theatres. Accurate and real time scheduling assist in predicting staffing needs, ensuring availability of required equipment and supplies and thus contribute to a smooth running operating theatre (Malhorta, 2006). An accurate schedule must list realistically the starting and ending time of each surgery. In addition, conflicts of schedules shall be resolved by the operating theatre manager (Malhorta, 2006). Schedules need to be rearranged according to agreed-on principles among all surgeons, on condition that guidelines are developed to define elective versus non-elective cases (Park *et al*,

2009). Many surgeons schedule their surgeries as emergency case thus staff might need to extend duty hours, other operations might need to be postponed thus result in corrupting the whole day plan. In addition some surgeons might accuse that the case was not an emergency. Accordingly literature does not question or challenge the level of urgency however recommend classifying surgeries as elective, where patient condition will not be affected as a result of delaying the surgery for a minimum of forty-eight hours, and nonselective. Under the concept of creating a realistic operating schedule, Malhorta (2006) reflected on the importance of having a real time based schedule which is essential to predict human and resource needs. The real time schedule requires accurately specifying the starting and ending time of surgeries with as much as possible accurate surgery duration. This real time requires timely updating as the day goes on. In addition, literature reflected the importance of defining the start time of each surgery and the impact of providing a precise duration to avoid confusion, allow proper allocation and distribution of surgeries and standardize data collection (Dexter *et al*,2005). Moreover, the importance of developing policies to streamline scheduling procedures was highly stressed. The procedure requires setting certain guidelines of what cases are to be scheduled as first day case, what is an elective case versus non elective.

Dexter *et al*. (2004) listed four important steps to assist in scheduling urgent cases and the related process to follow. Of these steps he included patient medical condition, evaluating patient waiting time, impact on OT efficiency and patient safety. Within these definitions it is essential to secure the surgeons agreement and commitment to abide by these guidelines and accordingly to abide by the scheduling process. This will reflect caring for all the surgeons similarly (Dexter *et al*, 2002). This is important from the surgeons' perspective, their surgery is the ultimate goal and the most important to perform (Calms *et al*,1992). An approach to decrease the first case delay along with an accurate recording and booking time with no "to-follow" schedule (Malhorta, 2006) should be put

in place. It was categorically rejected, as per literature, to have a “To Follow” designation of surgery (Malhorta, 2006; Macario,2010). Managing all these factors besides decreasing staff scheduling variation and ensuring adequate housekeeping services contributed in many studies to decrease the prolonged operating theatre turn-over time (McIntosh *et al*, 2006).

The turn over time describes the time delay between the first and the second surgery and measured by calculating the time the first case leaves an operating theatre on that day schedule to the time the second patient enters that same theatre and the impact of this delay on the suspension of all consecutive surgeries which will result in stretching the schedule time and extending the operating theatre working hours. Macario (2010) scored the value of turn over time in his study so that it reflects poor performance if it is more than forty minutes and for good performance it shall be less than twenty five minutes. In addition Macario (2010) & Shafer (2006) discussed elaborately the impact of cost reduction as a result of reducing the turn-over time. Yet, Macario (2010) defined the prolonged turn overtime to be more than sixty minutes and this shall not be counted within the regular turn over time. Exploring the block time impact on operating theatre utilization was studied through many case scenarios to provide actual examples and evidences that utilisation of operating theatre should not be used to plan additional block time (Wachtel *et al*, 2008).

In addition he introduced the concepts of tactical versus operational and strategic planning in allocating OT times. Wachtel *et al.* (2008) elaborated on allocating OT time based on operational plans that is staffing hours rather on tactical plans and he emphasised that strategic decisions requires years of planning before implementation. In this context he provided examples on each type of planning. He concluded that tactical planning to increase the total block time will increase OT capacity however might alter the clinical

care provided while operational planning doesn't affect the numbers or types of surgeries performed and these can be change or revised as needed. As we have explored, different studies considered many parameters, and the important is that these parameters are analysed to allow identifying a scientific mean to measure the improvement of operating theatre efficiency. In many studies it was significantly stressed that looking into few parameters alone is not enough and might trap and mask the analysis and consequently mislead the manager and lead to lose the expected outcomes (Dexter *et al,* 2002). From the perspective of evaluating operating theatre efficiency it is very important to study other human resource factors and not to solely evaluate operating hours and schedule parameters. Considering the allocated operating theatre time versus the allocated workload hours is not enough and we need to understand that studying these alone will provide insufficient information and will not guide us to a good decision (McIntosh *et al,* 2006). Macario (2010) described and listed a scoring system for measuring OT efficiency that consisted of eight objective criterions and elaborated that the eight criterions shall be studied and correlated together since they are related to each other in spite of having some more important than others. Calms & Shusterich (1992) described the operating theatre management and highlighted the need for a very strong coordination between human and material resources; in addition to the fact that the performance of the operating theatre is measured differently from different perspectives. Nurses understand efficiency as the competency in the clinical skills and the care they provide to patients with maximum safety measures taken; while managers focusing on disposable supply cost and percentage compliance with policies, availability of instruments and others (Macario, 2010). Thus it is important to look into operating theatre performance from the different perspectives.

Many studies highlighted importance of the leadership abilities of the operating theatre manager and the ability to resolve the interpersonal conflicts within the surgical

team more over to be able to make quick and effective decisions on the last minute changes required in the day of schedule (Plaster, 2003). Besides, others stressed the importance of having an operating theatre manager with defined scope of activities, ample authority, interested in leading and have good managerial skills. Many studies recommend that the operating theatre manager should be an executive senior level that has adequate knowledge with operating theatre setting, experienced in administration and business management. It was reported that in seventy-one *per cent* of the respondents to the survey conducted by the American Association of Clinical Directors (AACD)operating theatre managers were anesthetists (O'Neil *et al*, 2007).

Wullink et al., for instance, examined whether it is preferred to reserve a dedicated operating room or to reserve some capacity in all elective operating rooms in order to improve the responsiveness to emergencies.

Denton et al., for instance, examine how case sequencing affects patient waiting time, operating room idling time (i.e. surgeon waiting time) and operating room overtime. They formulate a two-stage stochastic mixed integer program (MIP) and propose a set of effective solution heuristics that are furthermore easy to implement. Note that patient waiting time may also be interpreted as the stay on a surgery waiting list.

Magerlein and Martin 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.[3]

According to Vanoostrum view, starting from a list of recurring procedure types that are frequently performed and hence have to be scheduled in each planning cycle, they decide what mix of procedures will be performed on what day and in which operating room. They aim at the minimization of the number of operating rooms in use and levelling of the hospital bed requirements[13.]

Blake and Carter elaborate on this taxonomy in their literature review and add the domain of external resource scheduling, which they define as the process of identifying and reserving all resources external to the surgical suite necessary to ensure appropriate care for a patient before and after an instance of surgery. They furthermore divide each domain in a strategic, administrative and operational level, although these boundaries may be vague and interrelated. Przasnyski structures the literature on operating room scheduling based on general areas of concern, such as cost containment or scheduling of specific resources.[4]

Woloszyn M, Virgone J, Mélen St al , Experimental Study of an Air Distribution System for Operating Room Applications. Ventilation should be on the principle that the direction of air flow is from the operation theatre towards the main entrance. Efficient ventilation will control temperature and humidity in OT, dilute the contamination by microorganisms and anaesthetic agents Ultra clean laminar air flow – the filtered air delivery must be 90% efficient in removing particles more than 0.5mm. Positive air pressure system in operation theatre: It should ensure a positive pressure of 5 cm H_2O from ceiling of operation theatre downwards and outwards, to push out air from operation theatre[12]

Adan and Vissers formulate a mixed integer programming model to identify the cyclic number and mix of patients that have to be admitted to the hospital in order to obtain the target utilization of several resources such as the operating theatre or the intensive care unit (ICU). In their case, outpatients are treated as inpatients with a length of stay of one day who do not necessarily need specialized resources such as the ICU.[5]

Denton et al., for instance, examine how case sequencing affects patient waiting time, operating room idling time (i.e. surgeon waiting time) and operating room overtime.

They formulate a two-stage stochastic mixed integer program (MIP) and propose a set of effective solution heuristics that are furthermore easy to implement.[6]

VanBerkel and Blake study use discrete-event simulation to examine how a change in throughput triggers a decrease in waiting time. In particular, they affect throughput by changing the capacity of beds in the wards and by changing the amount of available operating room time. Note that their operating theatre of interest is spread over multiple sites, which is rare in the literature.[7]

Dexter et al evaluate procedures based on the OR efficiency, which is a measure that incorporates both the underutilization and the overutilization of the operating room. Utilization actually refers to the workload of a resource, whereas under time or over-time includes some timing aspect. It is hence possible to have an underutilized operating room complex, although overtime may occur in some operating rooms.[8]

Marcon and Dexter, for instance, use discrete-event simulation to examine how standard sequencing rules, such as *longest case first* or *shortest case first*, may assist in reducing the peak number of patients in both the holding area and the post anaesthesia care Unit (PACU). A similar analysis of such sequencing rules is available. In this paper, however, the authors restrict the focus to the PACU and study, amongst other, its make span and the peak number of patients. The make span represents in this case the completion time of the last patient's recovery. In both studies, operating rooms are sequenced independently which resulted in a reduced complexity.[9]

Dexter *et al.* (2002) highlighted safety to be the building block for operating theatre efficiency. Studies elaborated on patient safety in relation to many aspects and highlighted the international awareness in this direction through developing patient safety goals and operating theatre standards that are compulsory for any health care institution to guard and Implement (JCIA, 4th ed.). Within that direction, the quality indicators can be

selected to measure safe practice and quality of care provided inside the operating theatre (Watson, 2006). Many international bodies considered patient safety a major concern in today's health care industry and shall take the first priority thus they recommended changes to the work environment (Gibbs *et al*, 2005). Each member of the operating team has a role and a responsibility however all shall pool into a common goal which is to provide safe, efficient and effective functionality. Staff and surgeons 'satisfaction studies are described to be good tools to assess the operating theatre work environment. These surveys help securing the staff perspectives and provide good feedback and provide theatre for improvement. These issues are identified by end users or front liners. The Lean principles, on the other hand, highlighted safety so as to prevent epidemiological risks through the shine component. Few examples of these issues that might relate to patient safety that was repeatedly discussed in literature are retaining foreign bodies (Butler *et al*, 2003). This problem is related to the lack of adequate communication among the team members, inconsistency in practice, and absence of standardized processes (Christian, 2006). Some studies emphasized the lack of communication between OT and other departments as laboratory and radiology will result in delaying operative procedures, prolonging anesthesia times and accordingly increasing the risk for the patients (Macario, 2010).

Others highlighted the importance of conducting "Time out" as an opportunity for everyone in the team to exchange and confirm information and to ensure performing the right surgery on the right patient at the right site (Macario, 2010). Different studies targeting patient safety correlated the importance of safety practices to the increased numbers of incidents and high morbidity cases reported as a result of surgical malpractices.

METHODOLOGY

STUDY DESIGN

This study was conducted in Primus Super Speciality Hospital situated in Chanakyapuri. It was an observational, cross sectional study to assess the utilization of operation theatres in the hospital.

STUDY PERIOD

The study was conducted from 1st Feb to 30th April.

STUDY AREA

Operation Theatre of Primus Super Speciality Hospital.

STUDY POPULATION

All the patients who came to the operation theatre of the hospital for surgery, irrespective of gender, age and health status.

SAMPLE SIZE

A sample size of 416 was taken for study.

SAMPLING METHOD

The sampling method used in the research was convenience sampling.

TOOL & TECHINQUES

Primary Data was collected by observational method and hospital records. The data collected was categorized and analysed using Microsoft Excel 2007.

DATA ANALYSIS AND FINDINGS

O.T QUALITY INDICATORS:

1.) The classic definition of OR utilization is the number of hours of O.T time actually used (including preparation time for the O.T) divided by the maximum number of hours the O.T can be functional.

The utilization of O.T. was calculated using the below formula:

$$= \frac{\text{Number of hours when O.T. was used + Preparation time for the O.T}}{\text{Maximum number of hours the O.T. can be functional}} \times 100$$

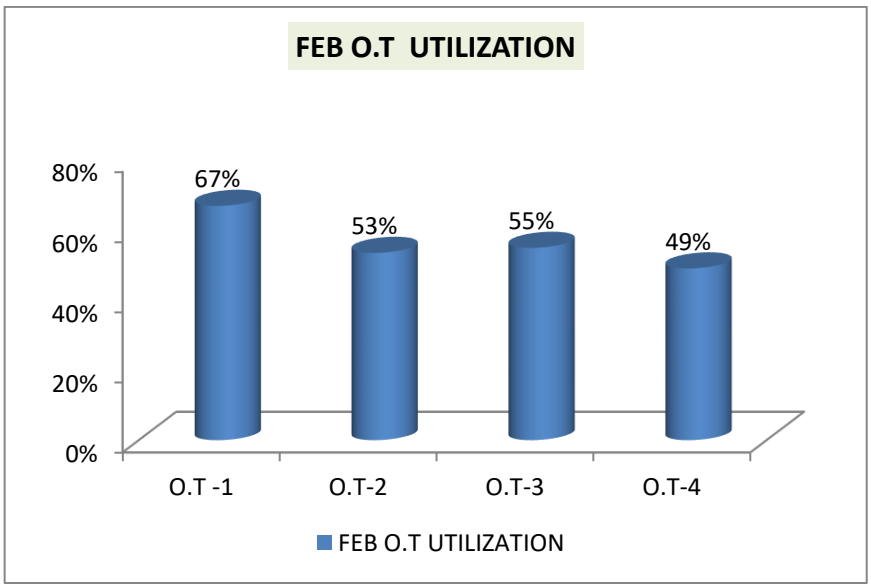

Fig 1.3 Feb O.T Utilization

Interpretation: The figure shows the O.T utilization of the hospital for the month of Feb. From the data that was collected and with the help of the graph above, it is clearly evident that O.T utilization was highest for O.T -1 i.e. 67% and lowest for O.T- 4 which was 49%.

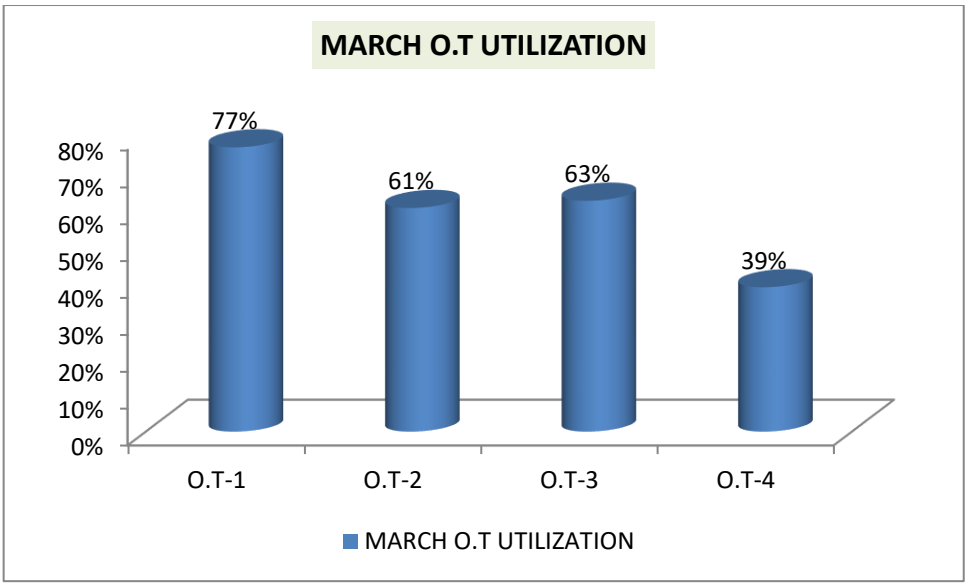

Fig 1.4: March O.T Utilization

Interpretation: The figure shows the O.T utilization of the hospital for the month of March. From the data that was collected and with the help of the graph above, it is clearly evident that O.T utilization was highest for O.T -1 i.e. 77% and lowest for O.T- 4 which was 39%.

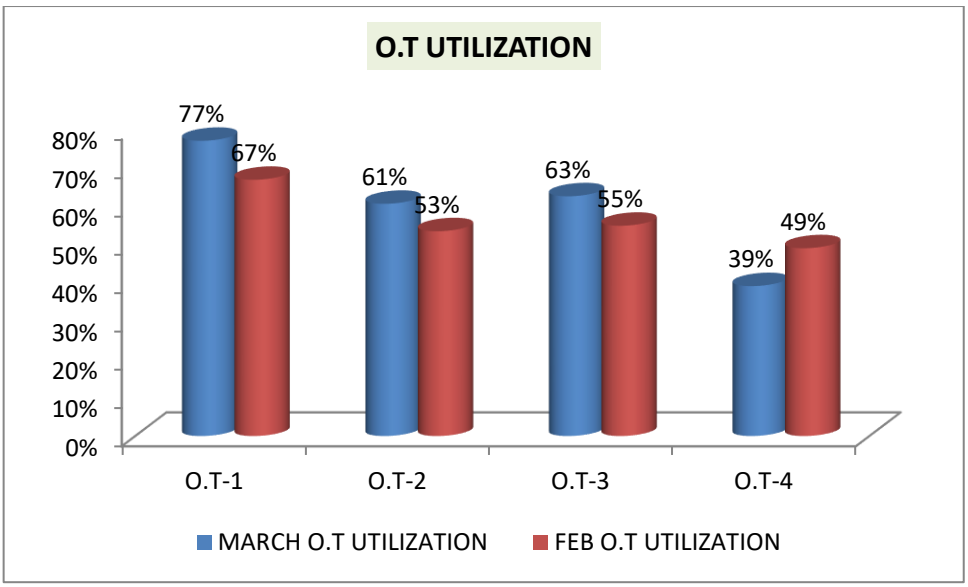

Fig 1.5 shows O.T utilization for Feb and March

O.T	MARCH O.T UTILIZATION	FEB O.T UTILIZATION
O.T-1	77%	67%
O.T-2	61%	53%
O.T-3	63%	55%
O.T-4	39%	49%

Table 1.3 O.T Utilization

Interpretation: The figure shows the O.T utilization of the hospital for the month of Feb & March. From the data that was collected and with the help of the graph above, it is clearly evident that O.T utilization has increased in the month of March than Feb except for O.T-4 for which the O.T utilization showed a decrease of 10%.

2.) Unplanned returns to O.T: Number of unplanned returns to O.T X 100

Number of patients operated

There were no unplanned returns to O.T for the month of Feb and March.

3.) % of Modification of Anaesthesia plan: The anaesthesia plan is the outcome of pre anaesthesia assessment. Any changes done after this shall be considered as modification of anaesthesia plan.

= Number of patients in whom the anaesthesia plan was modified X 100

Number of patients who underwent anaesthesia.

% Modification of anaesthesia was nil for both March and Feb.

4.) % rescheduling of surgeries: Number of cases rescheduled X 100

Number of cases performed.

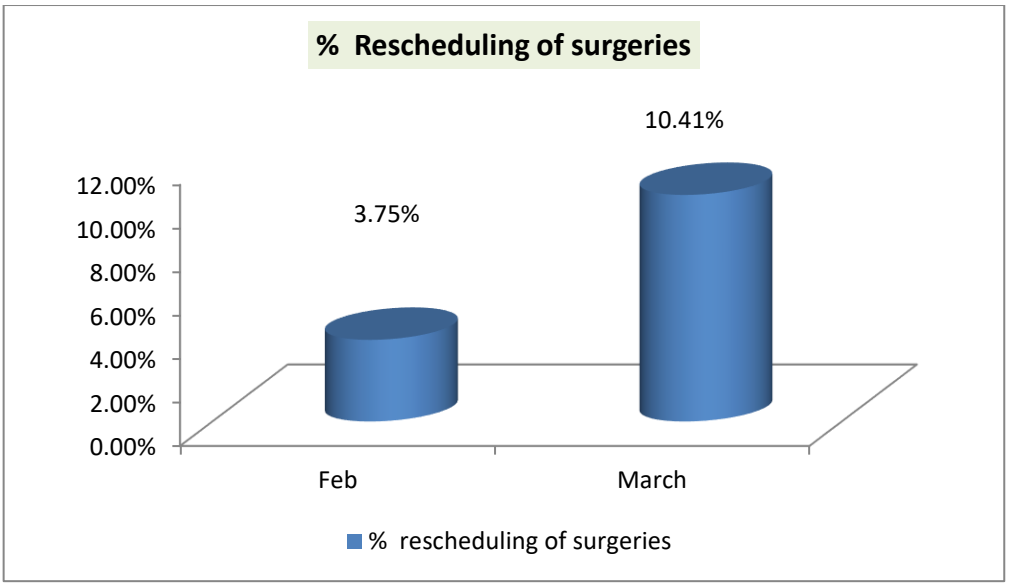

Fig1.26: Percentage Rescheduling of surgeries

Interpretation: The figure shows the percentage rescheduling of surgeries for the month of Feb & March. From the data that was collected and with the help of the graph above, it was observed that the % rescheduling of surgeries for Feb was 3.75% and for March was 10.41%. The graph shows an increase in % rescheduling of surgeries by 6.66%.

AVERAGE SURGERIES / DAY IN O.T

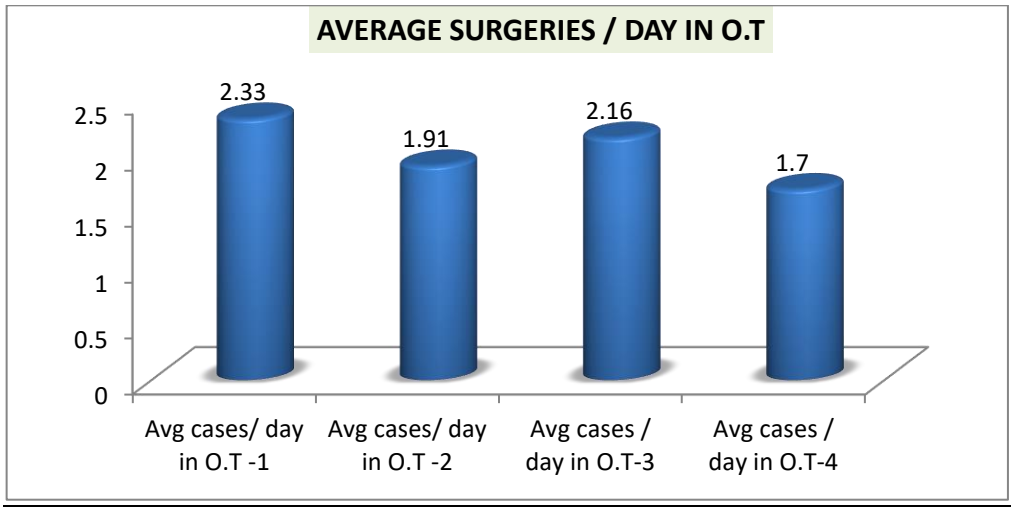

Fig 1.6 Average Surgeries/ day in O.T in Feb

Interpretation: The figure shows the average surgeries/ day in all 4 O.T's for the month of Feb. From the data that was collected and with the help of the graph above, it was observed that the average surgeries/ day in O.T-1 was 2.33 and highest and lowest average number of surgeries per day was found in O.T-4 which was 1.7 .

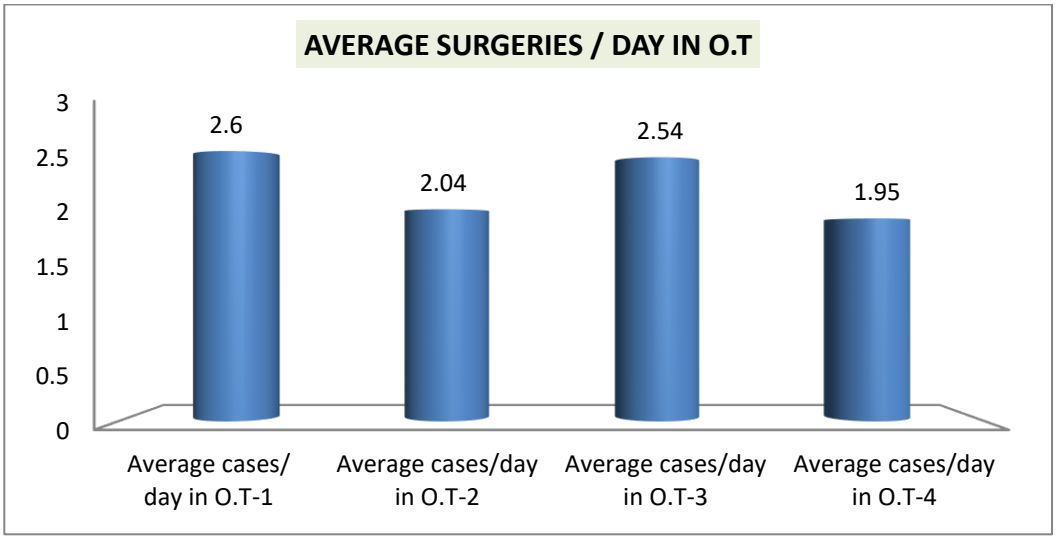

Fig 1.7 Average surgeries/ day in O.T in the month of March

Interpretation: The figure shows the average surgeries/ day in all 4 O.T's for the month of March. From the data that was collected and with the help of the graph above, it was observed that maximum no of surgeries are done in O.T-1 , since the average surgeries/ day in O.T-1 was 2.6 and minimum number of surgeries are done in O.T-4 .

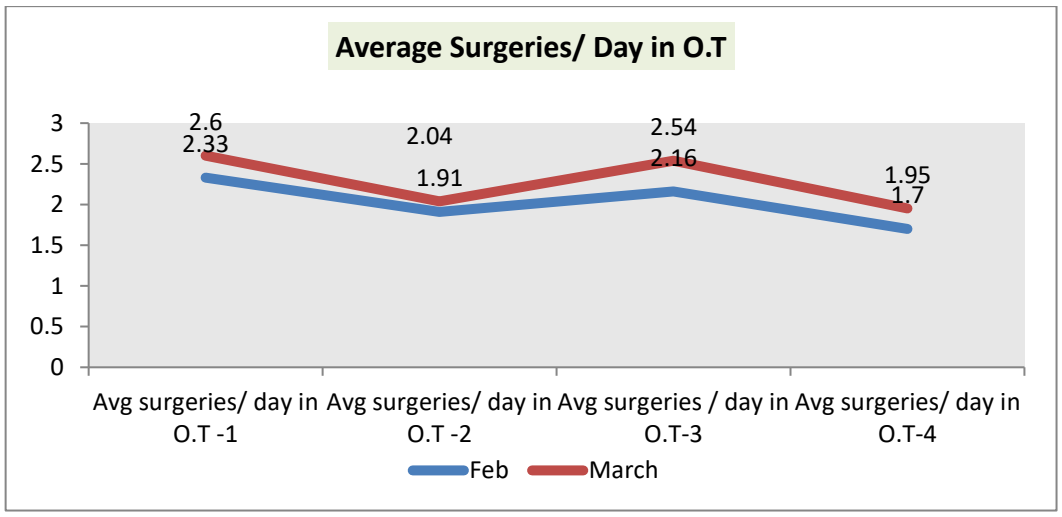

Fig1.8 Average Surgeries/ day in O.T for Feb and March

AVERAGE SURGERIES / DAY IN O.T	Feb	March
Average surgeries/ day in O.T -1	2.33	2.6
Average surgeries/ day in O.T -2	1.91	2.04
Average surgeries / day in O.T-3	2.16	2.54
Average surgeries/ day in O.T-4	1.7	1.95

Table 1.4 Average surgeries/ day in O.T for Feb and March

Interpretation: The figure shows the average number of surgeries for the month of Feb & March in all 4 O.T's. From the data that was collected and with the help of the graph above, it was observed that there is an increase in the number of surgeries in all four O.T's .

PERCENTAGE DISTRIBUTION OF SURGERIES

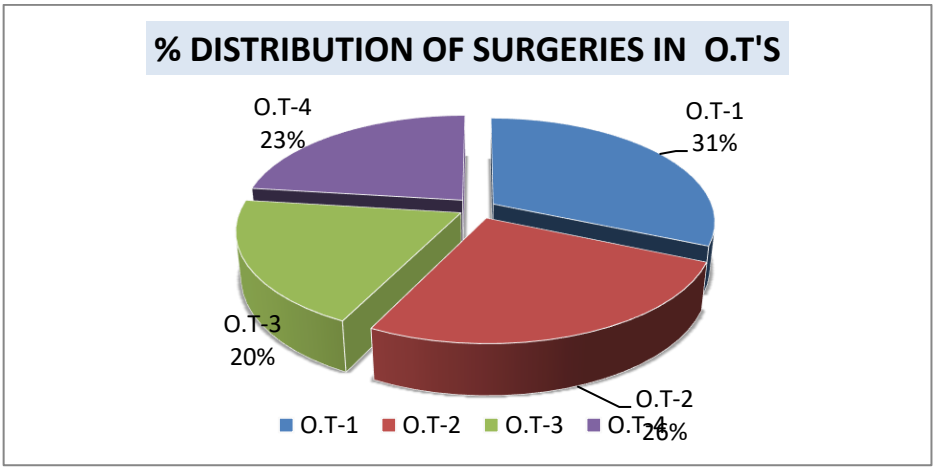

Fig 1.9 Percentage distribution of surgeries in all four O.T's in Feb

Interpretation: The pie chart shows the percentage distribution of surgeries for the month of Feb in all four O.T's. The pie chart shows that maximum number of surgeries was done in O.T-1 while minimum number of surgeries was done in O.T-4.

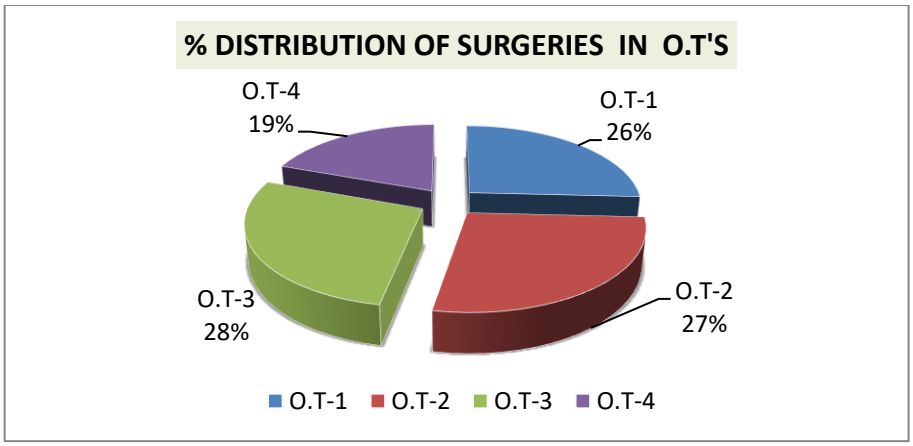

Fig 1.10 Percentage distribution of surgeries in all four O.T's in March

Interpretation: The pie chart shows the percentage distribution of surgeries for the month of March in all four O.T's. The pie showed that maximum number of surgeries was done in O.T-2 and minimum number of surgeries was done in O.T-4.

DELAY TIME

Date and scheduled time of the surgery was noted and the delay time was calculated from this time and the actual surgery start and end time. The start and end time of each surgery was noted. The whole process was tracked and delay time was computed.

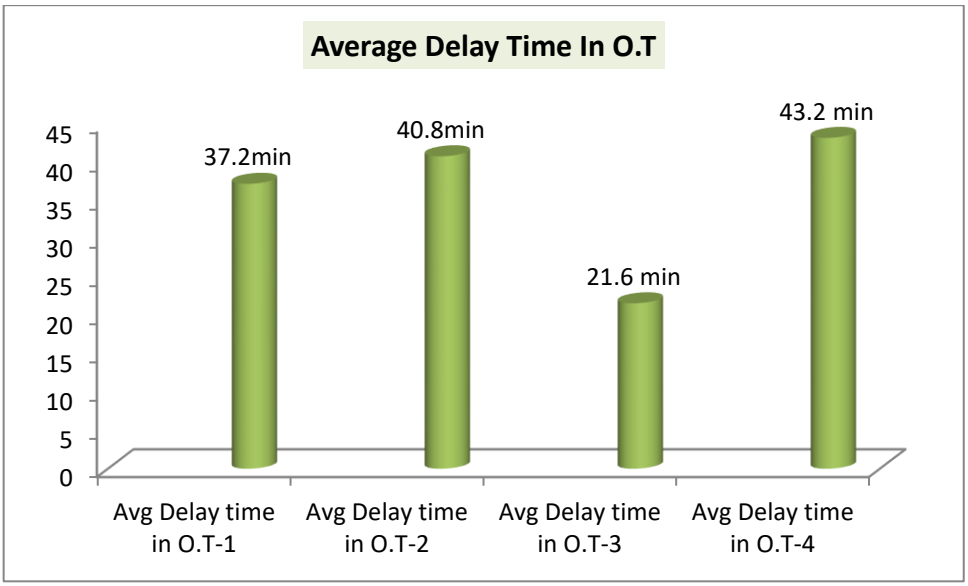

Fig 1.11 Average Delay Time in O.T in Feb

Interpretation: The figure shows the average delay time in O.T for the month of Feb. From the data that was collected and with the help of the graph above, it was observed that the average delay time was maximum in O.T-2 i.e. 40.8 min and minimum in O.T-3 (21.6 min).

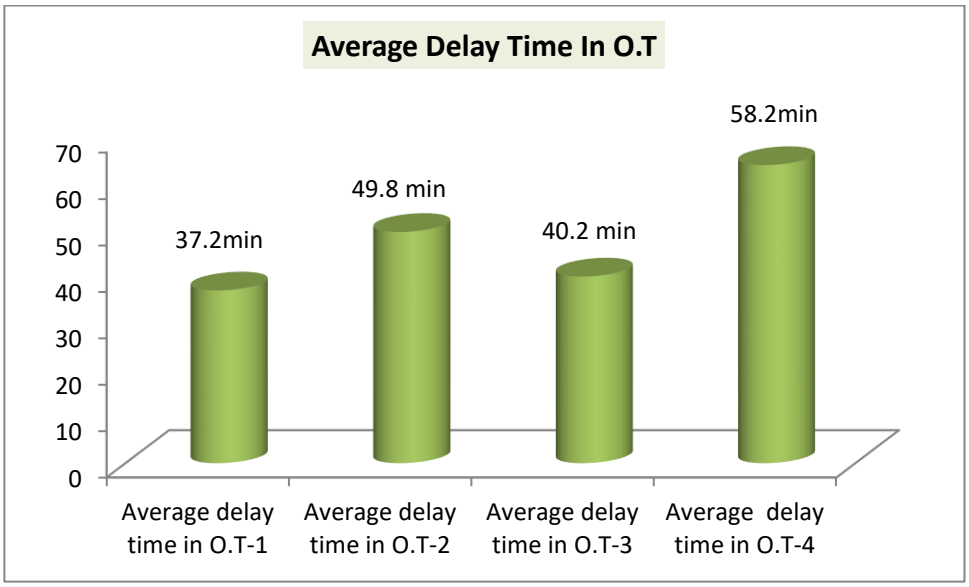

Fig 1.12 Average Delay Time in O.T in March

Interpretation: The figure shows the average delay time in O.T for the month of March. From the data that was collected and with the help of the graph above, it was observed that the average delay time was maximum in O.T-4 i.e. 58.2.min and minimum in O.T-1 i.e. 37.2 min.

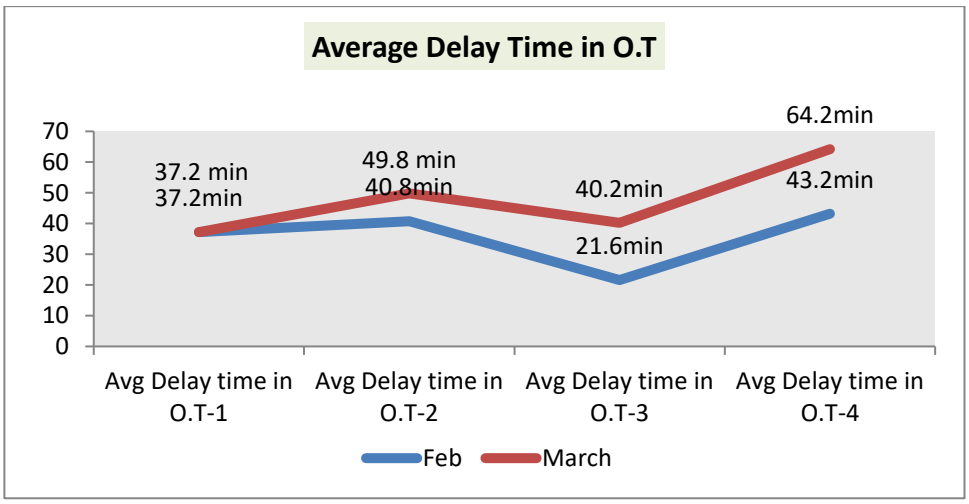

Fig 1.13 Average Delay Time in O.T

AVERAGE DELAY TIME IN O.T	Feb	March
Average Delay time in O.T-1	37.2 min	37.2 min
Average Delay time in O.T-2	40.8 min	49.8 min
Average Delay time in O.T-3	21.6 min	40.2 min
Average Delay time in O.T-4	43.2 min	64.2 min

Table 1.5 Average Delay time in O.T for Feb and March

Interpretation: The figure shows the average delay time in O.T for the month of Feb and March. From the data that was collected and with the help of the graph above, it was observed that the average delay time has increased in three O.T's (O.T-2, O.T-3,O.T-4) except for O.T-1 in which the delay time was found to be same.

TIME INTERVAL BETWEEN SURGERIES IN O.T:

Time interval between surgeries was noted down for each O.T. The end time of each surgery was noted. The whole process was tracked and time interval was computed.

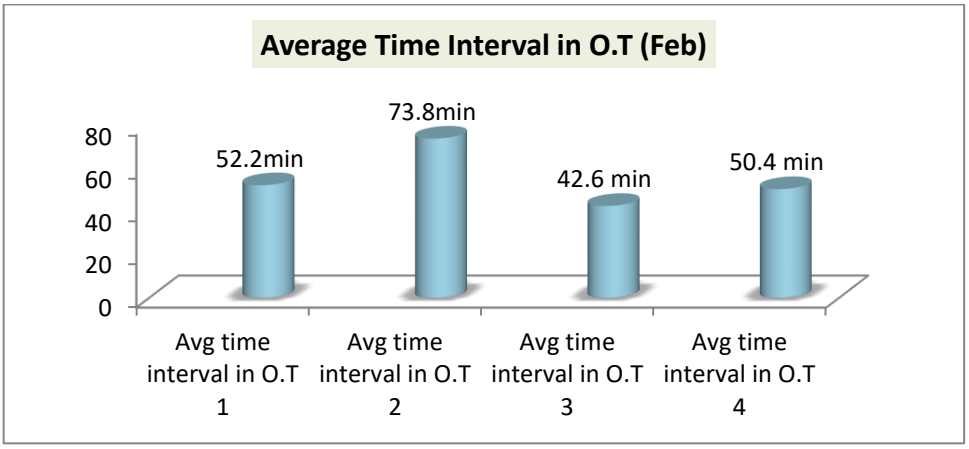

Fig 1.14 Time Interval in O.T in the month of Feb

Interpretation: The figure shows average time interval in O.T for the month of Feb. From the data that was collected and with the help of the graph above, it was observed that the average time interval was maximum in O.T-2 i.e. 1hour 23min (73.2min) and minimum in O.T-3 i.e. 42.6 min.

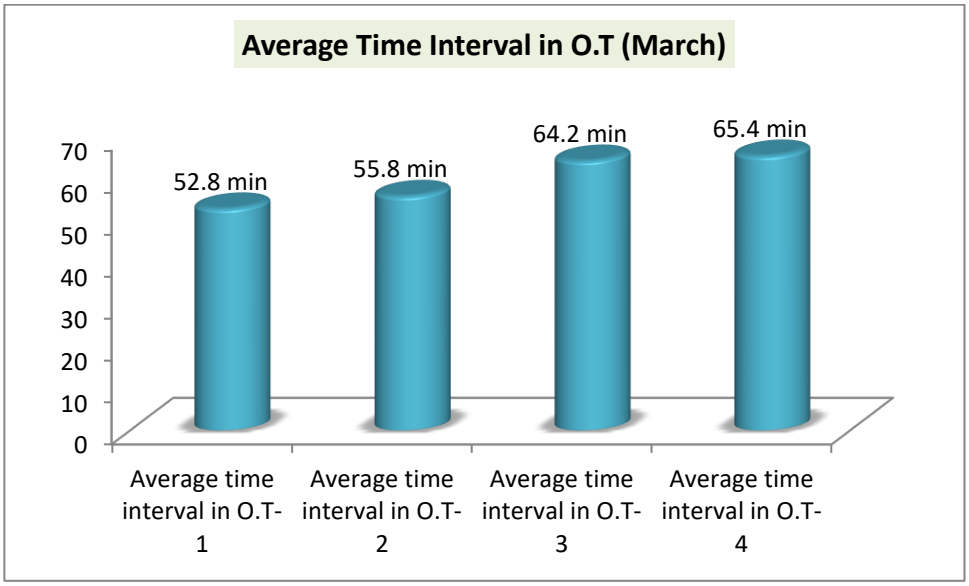

Fig1.15 Average Time interval in O.T in the month of March

Interpretation: The figure shows average time interval in O.T for the month of March. From the data that was collected and with the help of the graph above, it was observed that the average time interval was maximum in O.T-3 i.e. 1hour 9min (65.4min) and minimum in O.T-1 i.e. 52.8min.

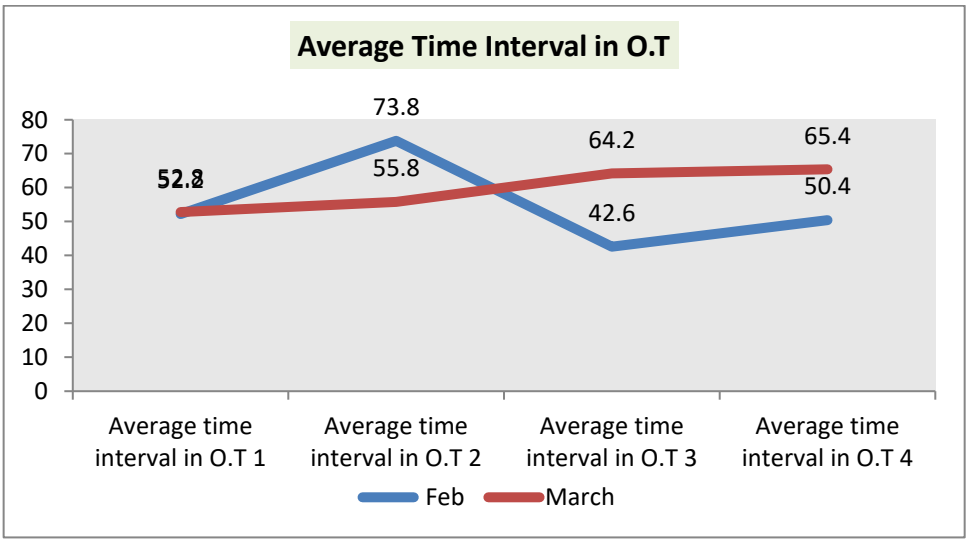

Fig 1.16. Average Time Interval in O.T for Feb & March

AVERAGE TIME INTERVAL IN O.T	Feb	March
Average time interval in O.T 1	**52.2**	**52.8**
Average time interval in O.T 2	**73.8**	**55.8**
Average time interval in O.T 3	**42.6**	**64.2**
Average time interval in O.T 4	**50.4**	**65.4**

Table1.6 Average time interval in O.T

Interpretation: The figure shows average time interval in O.T for the month of Feb & March. From the data that was collected and with the help of the graph above, it was observed that the average time interval has increased in O.T-1, 3and 4 but, in O.T-2 the average time interval has decreased.

SPECIALITY WISE SURGERIES DONE

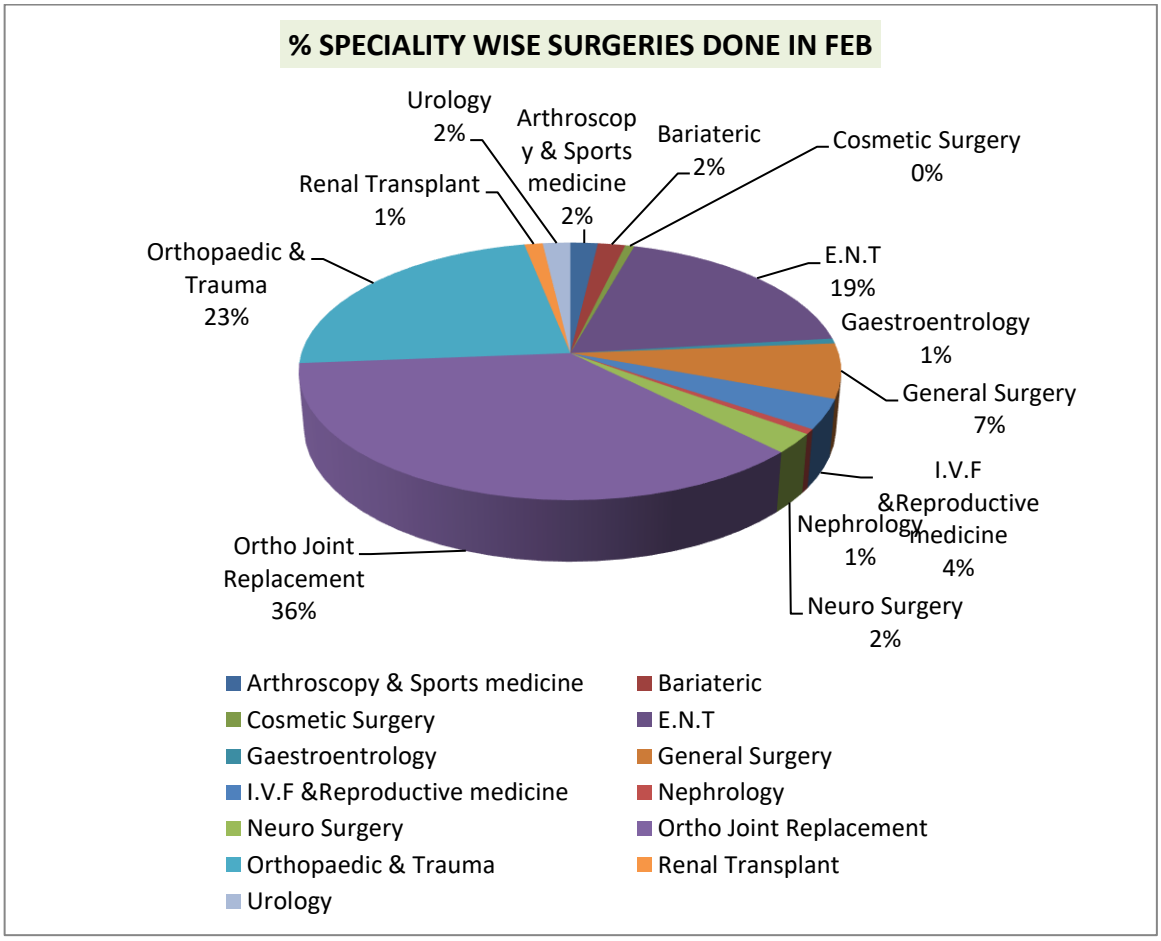

Fig1.17 Percentage of surgeries done in Feb speciality wise

Interpretation: The pie chart shows the percentage of surgeries done, speciality wise in

the month of Feb in all 4 O.T's. The pie chart showed that maximum number of Ortho Joint Replacements were done which constituted 36% of total surgeries while minimum number of surgeries were done in Gastroenterology, Nephrology, Renal Transplant (1%) and Cosmetic Surgery.

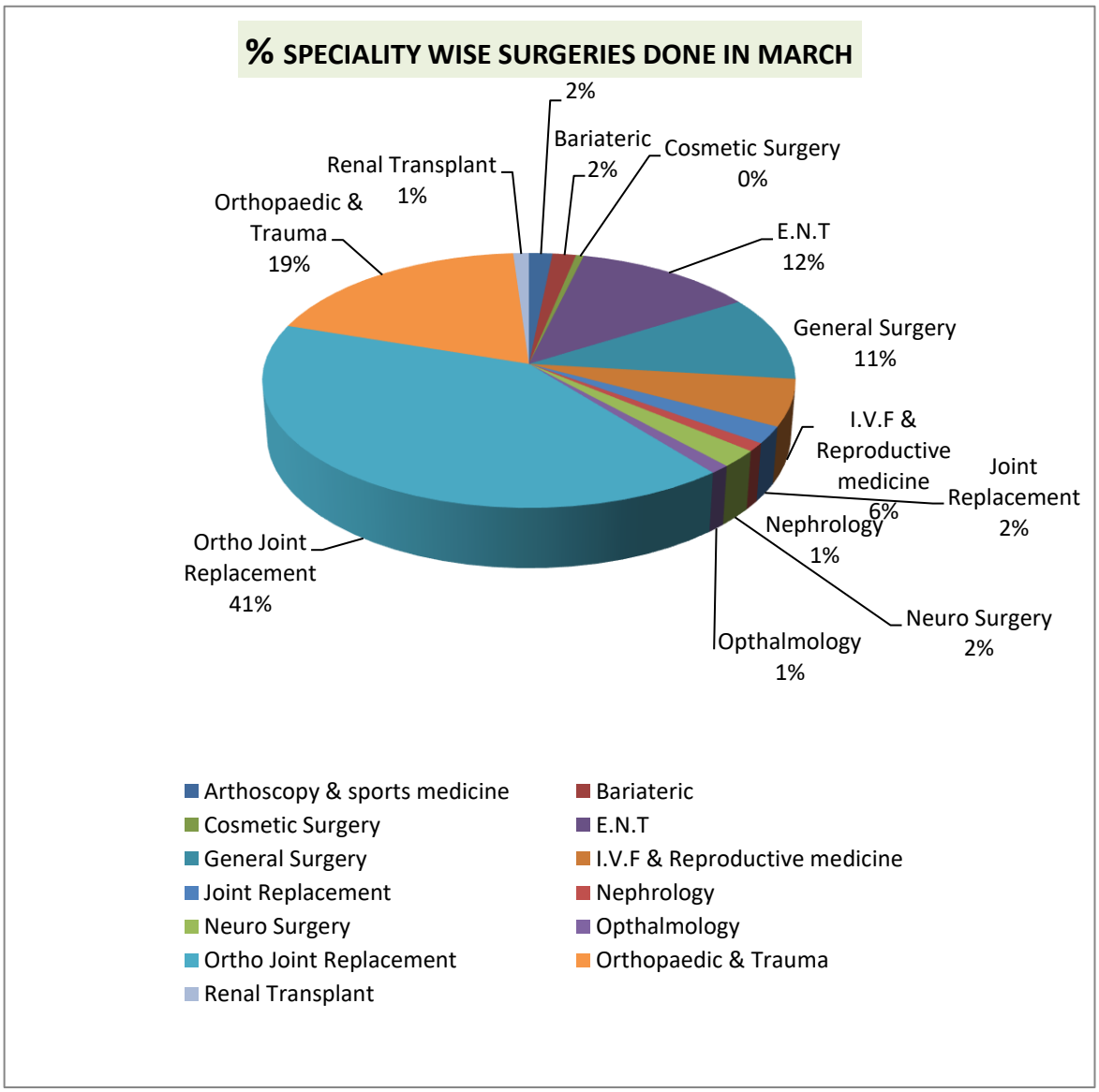

Fig1.18 Percentage of surgeries done in Feb speciality wise

Interpretation: The pie chart shows the percentage of surgeries done in the month of March speciality wise in all 4 O.T's. The pie chart showed that maximum number of

Ortho Joint Replacements were done, which constituted 41% of total surgeries while minimum numbers of surgeries were done in Gastroenterology, Nephrology, Renal Transplant (1%) and Cosmetic Surgery.

REASONS FOR DELAY IN O.T

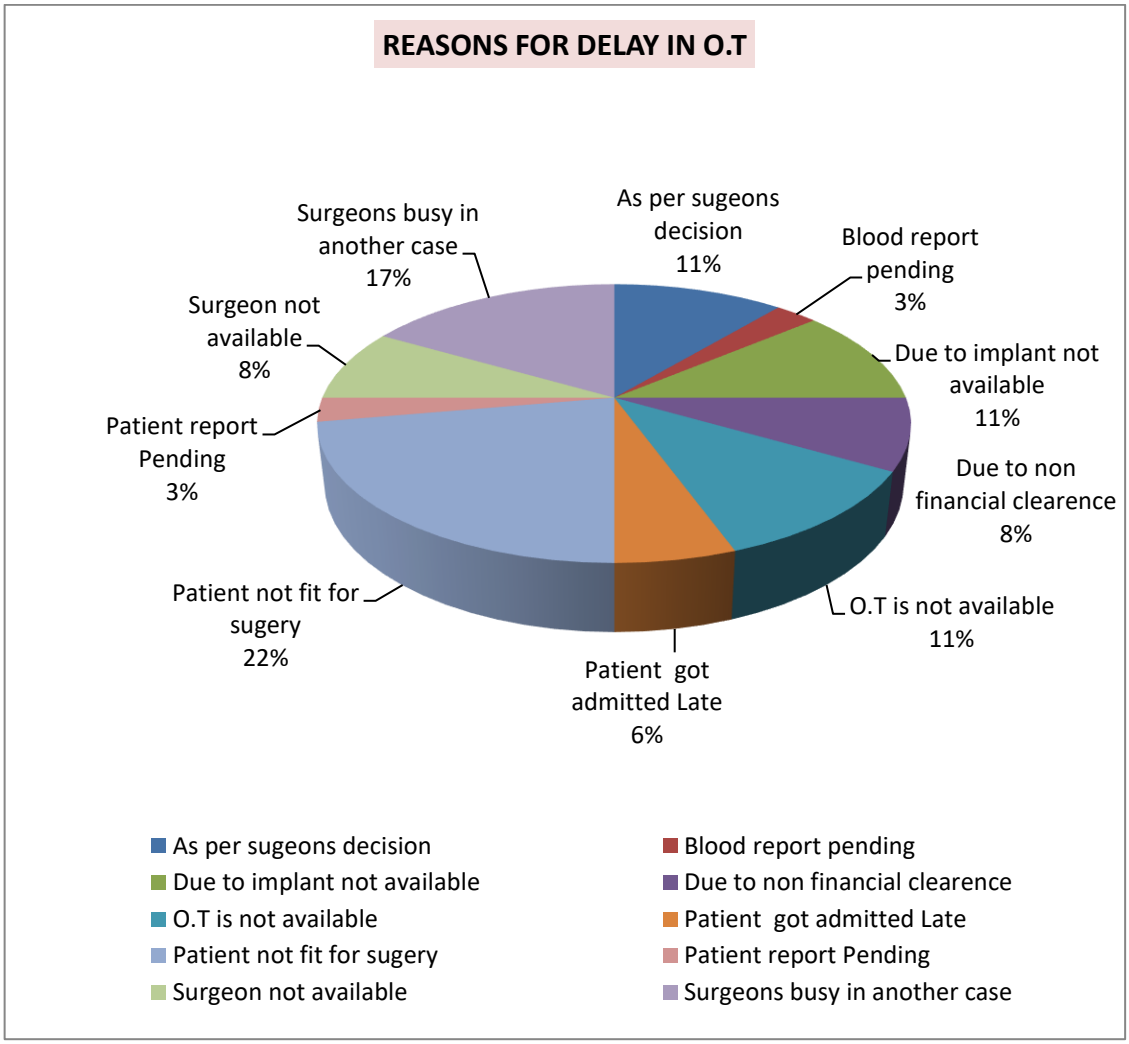

Fig 1.19 Reasons for delay in O.T in last one year (2013)

Interpretation: The pie chart shows the reasons for delay in the O.T. A Retrospective study was done on basis of past records and analysis of department statistics of last year, to analyse the major reasons for delay in the O.T. The pie chart showed that the major reason for delay in O.T in last one year was that the patient was not fit for surgery which constituted 22% and the lowest reason for delay was that patient's reports were pending.

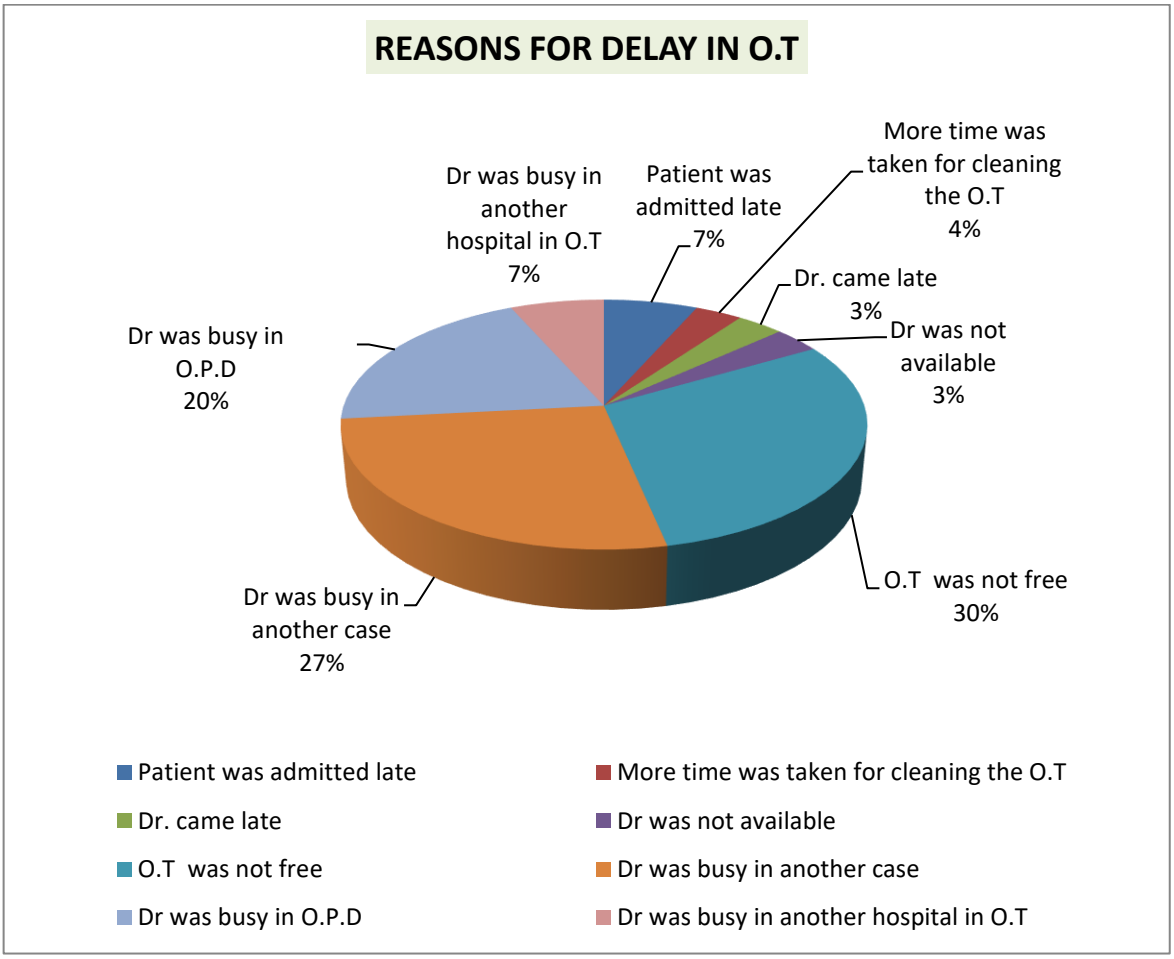

Fig1.20 Reasons for Delay in O.T in the month of Feb and March 2014

Interpretation: The pie chart shows the reasons for delay in O.T in the month of Feb & March. The pie chart showed that the major reason for delay of surgeries in O.T in the month of Feb & March was that O.T was not free which constituted 22% and the lowest reasons for delay in O.T was that the Dr was late & Dr was not available for surgery.

UTILIZATION OF EQUIPMENT

Use Co-efficient is applied to assess the utilization of equipment to see whether the equipment is optimally utilized or underutilized. Use Co-efficient of equipment may be measured by the following formula.

Use co-efficient % = (N/M)*100 where N is average no. of hours the equipment is used per day and M is maximum number of hours the equipment can be used per day. If the

Use co-efficient is less than 50%, equipment is considered to be underutilized.

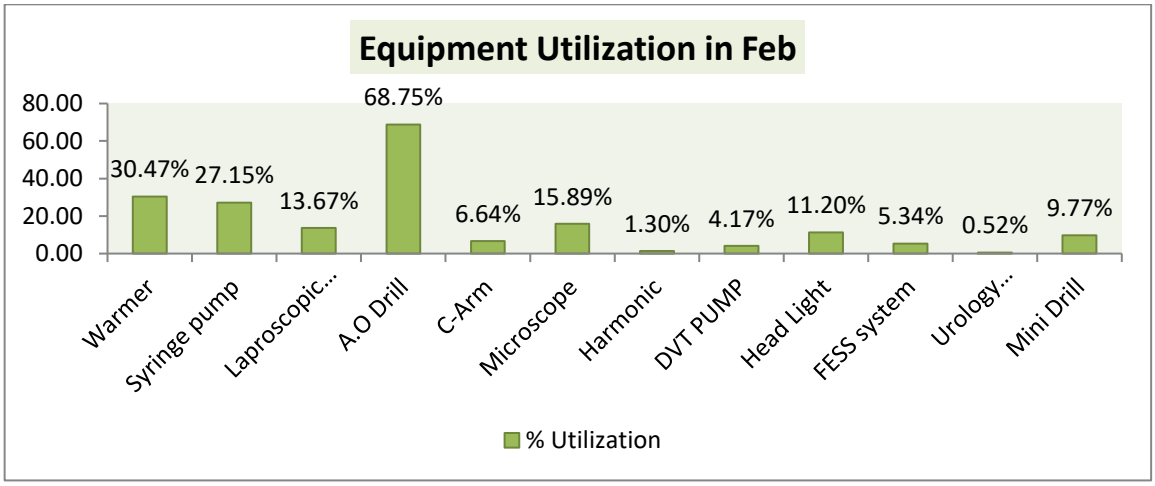

Fig 1.21 Use co-efficient % of equipments in Feb

Interpretation: The figure shows the use co-efficient % of equipments for the month of Feb. From the data that was collected and with the help of the graph above, it was observed that the use co-efficient of equipments is less than 50% , most of the equipments were under utilized, except for A.O drill which was 68.7% utilized.

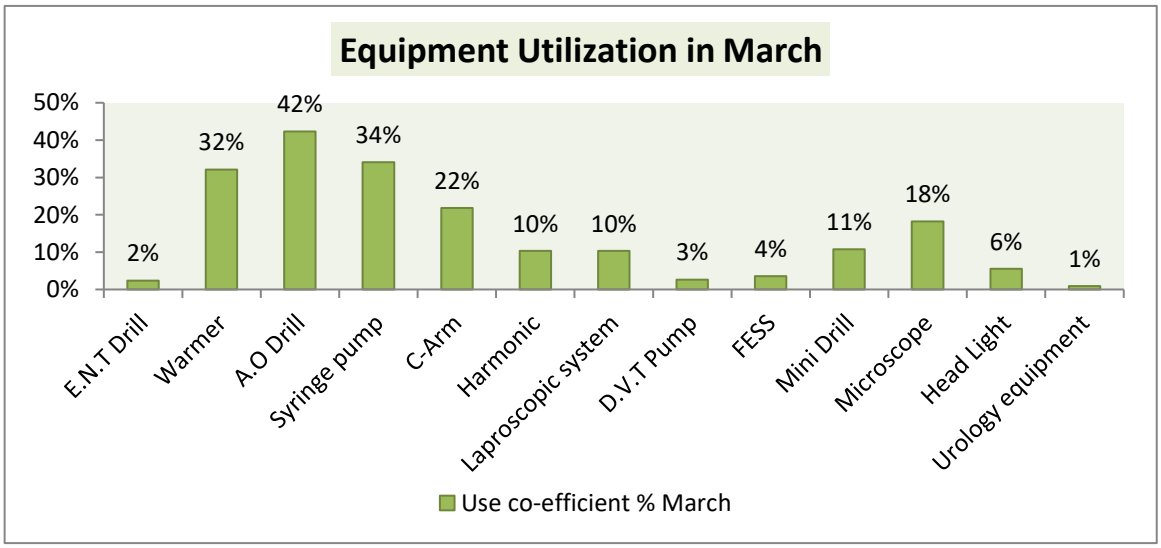

Fig Use co-efficient % of equipments in March

Interpretation: The figure shows the use co-efficient % of equipments for the month of March. From the data that was collected and with the help of the graph above, it was observed that the use co-efficient of equipments is less than 50% hence most of the equipments were under utilized. Out of all the equipments, the A.O Drill had the highest use coefficient % which was 42%.

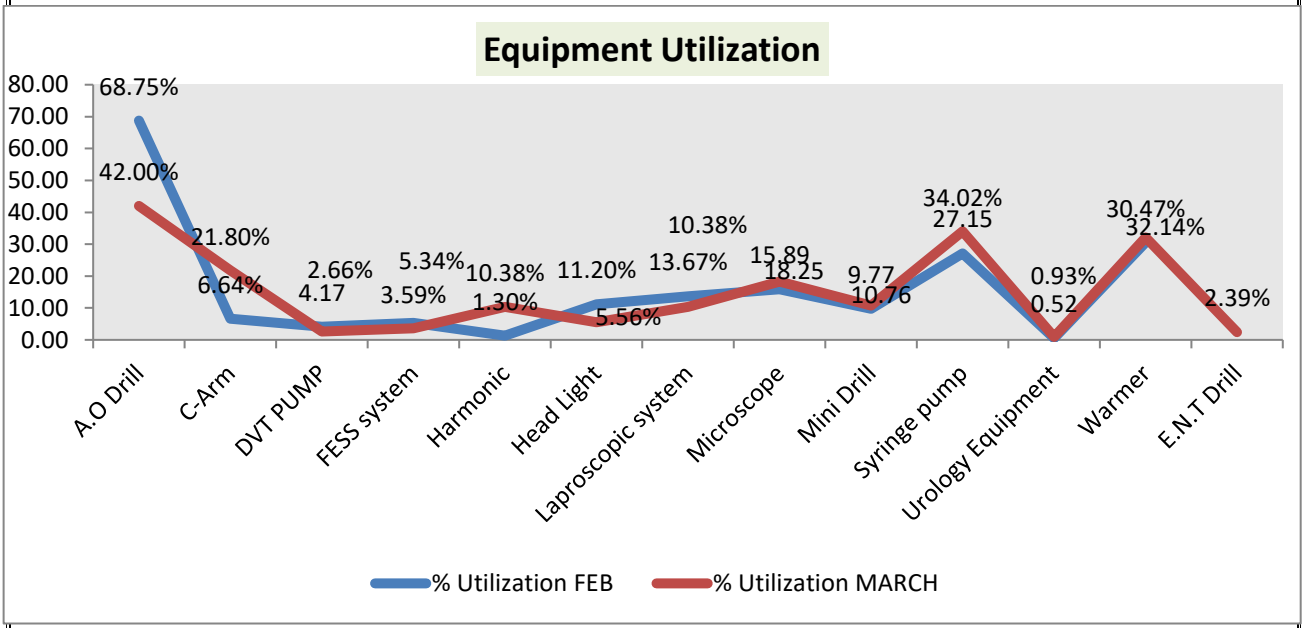

Fig 1.23 Use co efficient of equipments in Feb & March

Equipment	Use co-efficient % FEB	Use co-efficient % MARCH
A.O Drill	68.75 %	42.0 %
C-Arm	6.64 %	21.80 %
DVT PUMP	4.17 %	2.66 %
FESS system	5.34 %	3.59 %
Harmonic	1.30 %	10.38 %
Head Light	11.20 %	5.56 %
Laparoscopic system	13.67 %	10.38 %
Microscope	15.89 %	18.25 %
Mini Drill	9.77 %	10.76 %
Syringe pump	27.15 %	34.02 %
Urology Equipment	0.52 %	0.93 %
Warmer	30.47 %	32.14 %
E.N.T Drill		2.39 %

Table1.7 Use co-efficient % of Equipments in Feb & March

Interpretation: The figure shows the use co-efficient % of equipments for the month of Feb & March. From the data that was collected and with the help of the graph above, it was observed that the use co-efficient of the equipments is less than 50% hence most of the equipments were under utilized except for A.O.Drill. Out of all the equipments, the A.O Drill had the highest use coefficient % which was 68.75% in Feb and 42% in March. The urology equipment was least utilized having the use coefficient % of nearly 1%.

AVERAGE TIME FOR DIFFERENT SURGERIES:

Average time for different surgeries was noted down. The whole process was tracked and time was computed.

PROCEDURE	TIME (hour)
LAP. SLEEV GASTRECTOMY	2.25 hr
UMBILICAL HERNIA REPAIR	1 hr
LT. THR	2.25 hr
LAP. APPENDIX	3.25 hr
A.C.L	2.08 hr
ORIF- RADIUS	2 hr
BIPOLAR	1.75 hr
TONSILLECTOMY VIA COBLATION	1.12 hr
LT. TKR	1.9 hr
ARTHROSCOPY MENISECTOMY	1 hr
RT.TKR	1.85 hr
ABD. HYSTRECTOMY with BSO	2.75 hr
ORCHIDOPEXY	0.75 hr
COCHLEAR IMPLANT	3 hr
DISTAL RADIUS HEAD	1.75 hr
ORIF-OLECRENON	1.75 hr
HEMI-THYROIDECTOMY	2.62 hr
DIAG. HYSTROSCOPY	1 hr
LT.THR	2.5 hr
ING. HERNIA	1 hr
B/L TKR	3.04 hr
RT.THR	2 hr
ING. HERNIA	1 hr
MORTON NEUROMA EXCISION	0.75 hr
FEMUR PLATING	2.5 hr
B/L TYMPANOPLASTY	4 hr

Femur Nailing	**2 hr**
Orif Ankle	**1.75hr**
Removal of Implant Tibia	**1 hr**
Lipoma Excision	**0.5 hr**
Adenoidectomy with gromet insertion	**2.25hr**
Tympanoplasty	**1.5 hr**
Lapro Hystroscopy	**1.5 hr**
Diag.Hystroscopy	**1.25hr**
Colonoscopy	**1 hr**
Pump Cath Insertion	**1.25hr**
Arthroscopy	**1 hr**
Adenotonsillectomy via colbation	**1.31hr**
Pan Endoscopy	**1 hr**
Arthroscopy Debridment	**1 hr**
Septoplasty with turbinate reduction	**1.75hr**
sub total thyroidectomy	**2.75hr**
Adenotonsillectomy via colbation	**1.25hr**
Hemi-Thyroidectomy	**3.25hr**
Adenoidectomy with turbinate reduction	**3 hr**
Excision of Lession with Z plasty	**3 hr**
Tonsillectomy via Coblation	**1 hr**
Lymph node Excision	**1 hr**
Wound Debridement	**1.5 hr**
Septo Rhinoplasty	**5.25hr**
Abdominal Hystrectomy	**2.75hr**

Table1.8 Average time for different surgeries

PATIENT SATISFACTION LEVEL FOR O.T

Patient satisfaction level was assessed for O.T services through I.P.D feedback forms. The patient's were asked to fill the feedback form at the time of discharge, patient's were asked to rate the services for different departments in the hospital. The patient's in order to give their feedback had to rate the services as excellent, good, average and poor.

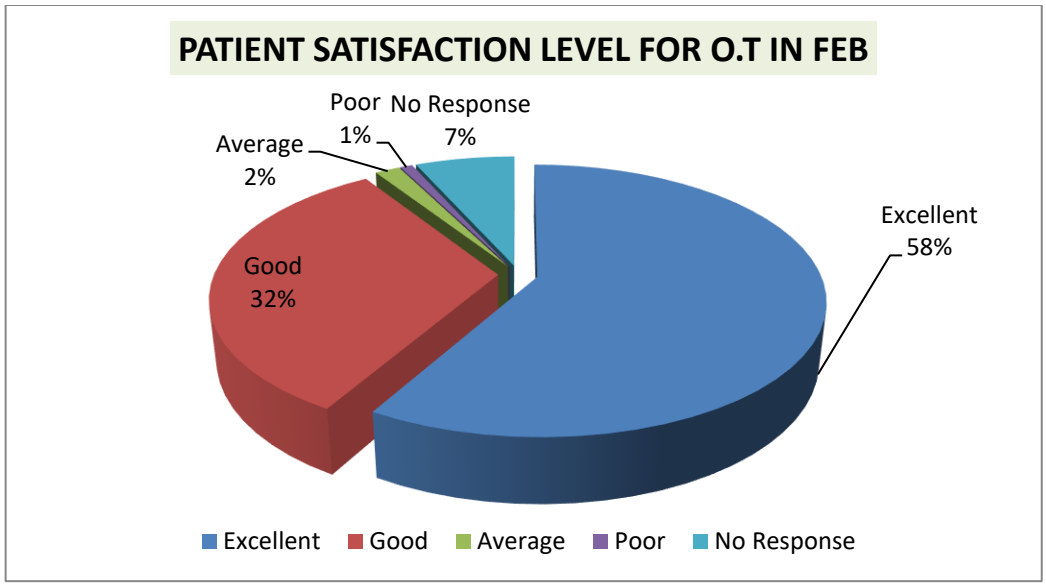

Fig1.24 Patient satisfaction level for O.T in the month of Feb

Interpretation: The pie chart shows the patient satisfaction level for O.T in the month of Feb. From the data that was collected and with the help of pie chart, it was observed that 58% patient's who availed the services of O.T were highly satisfied. Only 1% of patient were dissatisfied with the O.T services.

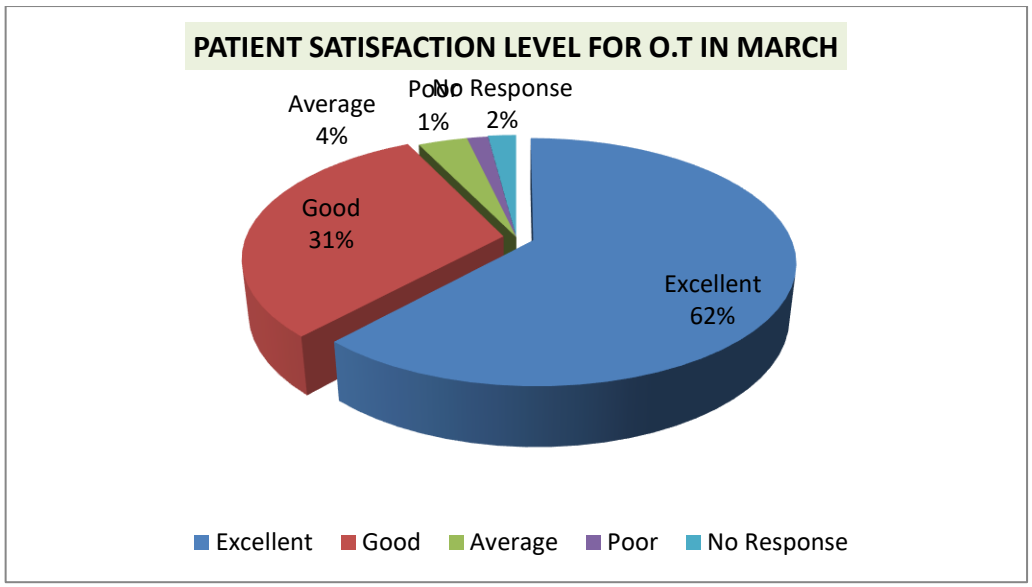

Fig 1.25 Patient satisfaction level for O.T in the month of March

Interpretation: The pie chart shows the patient satisfaction level for O.T in the month of March. From the data that was collected and with the help of pie chart above, it was observed that 62% patient's who availed the services of O.T were highly satisfied. Only 1% of patient's were dissatisfied with the O.T services

MANPOWER IN O.T

Current Manpower

Nurses (including nursing supervisor)	**6**
Technician Total no	**7**
Morning	**5**
Night	**1**
Evening	**1**

Optimal Manpower

Staff		**Total**
Nurses		
Nurses per O.T	**2each (1 scrub+1 circulating)**	**8**
Pre operative room	**1**	
Night shift	**1**	
Nursing Supervisor	**1**	
	Total	**11**
Technician		
one each in O.T	**4**	
Night shift	**1**	
Evening Shift	**1**	
I.V.F/shifting/equipment	**1**	
	Total	**7**
Total	**3 staff per O.T**	**(1tech+2 nurse)**
For increase at 200-300 patients*		**3 staff**
For increase at 300-400 patients*		**4 staff**
***As per I.N.C**		

Table1.9 Current and optimal manpower in O.T

Interpretation: The table shows the current and optimal manpower in O.T. Staffing of the operating room, in terms of anaesthetists, nurses and other support staffs is important for efficient running of theatre and this number should be on par with the clinical activity. Currently there were 6 nurses including the nursing supervisor and 7 technicians, ideally as per norms there should be three staff per O.T i.e. 2 nurses, one scrub nurse , 1 circulating nurse and one technician per O.T is recommended. As per I.N.C (Indian Nursing Council) there should be a ratio of 1:2 nurses in major O.T and 1:1 in minor O.T's.

CHECKLIST FOR O.T:

STRUCTURE	
Is HVAC System present inside OT	yes, its present.
Is proper Zoning concept followed(Clean zone, protective zone, sterile zone, and disposal zone)	Clean and dirty traffic not segregated.
Is the number of OT tables present in the hospital appropriate for the daily load	yes , the no of O.T table is appropriate for the daily load
Does the OT have a hand washing facility	Three scrub stations are there , one scrub station is not working properly, the second scrub station is sensor operated wheras the third one is not sensor operated.
Is the fire fighting system available in the unit	Yes, they are available, fire extinguisher is present outside the O.T , inside smoke detectors and water sprinklers are present.
Is continuous water available for the unit?	yes , continuous water supply is available for the unit
Is the changing room available for the doctors and nurses	Yes , changing room is available for the doctor's and nurses
Is there a continuous power back up for OT	yes, continuous power back up is there for the O.T
Does the OT have a crash cart	Yes each O.T has its own crash cart

Does the OT have defibrillator	Yes
Does the OT have an ECG monitor	5 in pre operative room and four in each O.T
Does the OT have oxygen supply	yes
Does the OT have shadow less OT light	yes
Is the staff provided with the personnel protective devices	Yes, they are wearing head caps, gowns,shoe covers etc
Is scrubbing area present for the O.T	
PROCESS	
Is the consent for the surgery and anesthesia taken from the patient	yes, its taken
Is the OT list prepared	yes O.T list is prepared one day before
Is the OT booking being done	Yes booking of O.T is done
Is the preparation of patient done before the operation	Yes
Does the nurse enter the patient details in the OT register	Yes , the nurse enters the details in the register
Are the number of OT instruments counted before and after operation	yes it is counted
Is OT disinfection done after every procedure	yes
Is the pre anesthesia check up done by the anesthetists	Yes, pre anesthesia check up is done
Is pre, intra, post operative notes are documented	yes, they are documented.
Is infection control practices being followed in OT	yes
Is sign in , time out , sign out being followed	yes , its being followed
Is bio medical waste management practices being followed	Sometimes, sharps were not in the sharp collector

Table 1.10 Checklist for O.T

DISCUSSION

Operation theatre (OT) is the heart of a hospital requiring considerable human resources and expenditure from hospital budget. However, OT's are underutilized and lie idle at times. Enhancing the efficiency of operating theatre has been always a challenging process especially in a quick changing healthcare sector with increased patient care complexity. The major aim of the study was to assess the utilization of operation theaters in the hospital.

The study was conducted in operation theatre department of the hospital. A sample size of 416 was taken and was selected by convenience sampling method. Primary data was collected by observational method and hospital records and data was analyzed with the help of Microsoft Office Excel 2007. The study revealed that although the hospital had four operation theatres and well developed hospital management information system the hospital was facing delays in the scheduled surgeries. From the data that was collected, the result showed that the overall O.T utilization of all four operation theatres in Feb was 55.99% and in March was 59.77%.The result shows that the operation theaters have low utilization and were underutilized and lie idle at times.

There were no unplanned returns to O.T and percentage modification of anesthesia was nil for both the months. The percentage rescheduling of surgeries for Feb was 3.75% whereas for March it was 10.41%. From the data that was collected it was observed that the overall average delay time for surgery for all four O.T's was 35.7 min in Feb whereas for March the delay time increased to 47.85min.The overall average time interval for O.T was 54.75min in Feb and 59.55min in March. Patient satisfaction level was assessed for O.T services through I.P.D feedback forms. From the data that was collected it was observed that 58% patient's who availed the services of O.T were highly satisfied and only 1% of patient were dissatisfied with the O.T services in Feb. For March, it was observed that

62% of patients were highly satisfied with the services of O.T and only 15 were dissatisfied

LIMITATIONS OF THE STUDY

- The main constraint was time as there was limited time to complete the study.
- Sample size of the study is small because study phase was short.
- Financial analysis could not be done because financial data was not provided by the hospital.

RECOMMENDATIONS

The O.T management is an example of perfect team management, where a variety of personnel ranging from highly skilled surgeons to minimal skilled O.T attendants, work under tremendous stress and strain with long duration of work in uncomfortable posture. In view of the above analysis and observations, the following recommendations are suggested:

- Punctuality: Time saving technique depends considerably on operating room discipline. It is important that all lists begin and end at times agreed and adhered to by the theatre users as it will help in following

    a. Anesthetist will have time to visit the patient preoperatively.
    b. Timely preparation of patient.
    c. Increased ability to match staff to workload in theatre and recovery units.
    d. Staff can take meal breaks reducing fatigue.
    e. A reduction in need for overtime

❖ Punctuality by everybody concerned with the operating schedule is important.

- ❖ The first case of the day should begin promptly when scheduled i.e."KNIFE" at that time instead of the patient being wheeled in at the time.
- ❖ All delays should be investigated and discipline enforced with suitable penalties and motivation.

a.) Same day admissions should be scheduled for surgery in the afternoon.

b.) First case should reach O.T. in time from the ward, to allow the O.T. to be started on time.

c.) If instruments are ready in advance, the assistants are available in the room, gowned and gloved before entry of the operating surgeon; the duration of patient occupancy of the room will be considerably decreased.

d.) From patient's perspective, the staff should greet and introduce themselves to patients and explain what they are doing.

e.) Patient should not be kept waiting in the preoperative area for more than 30 minutes.

f.) Scheduling of hospital operation theatre can be divided into open scheduling, block scheduling and modified block scheduling:-

- Open scheduling allows surgical cases to be assigned to an operating room available at the convenience of the surgeons.
- For block scheduling, specific surgeons are assigned a set of time block normally for some weeks or months into which they can arrange their surgical cases. The surgeons 'own their time blocks, none of those time blocks can be released'.

- Modified block scheduling is modified into two ways to increase its flexibility .Either some time is blocked and some is left open or unused. Blocked time is released at an agreed upon time in 72 hrs.

g.) Infectious patient should be put on the end of the list to avoid delays caused by contamination of the theatre.

h.) The scheduling of surgeries should be done by keeping in mind the average time taken for each surgery.

i.) Every surgeon should be allotted sessions and audits should be conducted on a monthly basis. The amount of time allotted to a surgeon should be tabled against the amount of time he actually operates in a theatre. This allows us to reschedule sessions, avoid under utilization of one area and over-running of other theatres.

j.) The doctor should initiate the coordinator to book for surgery, when patient is confirmed for surgery.

k.) Same day admission was not investigated before admission for routine investigations by which time could be saved for investigational delays.

l.) Training & Development of all O.T staff in the O.T techniques as well as in the procedures/protocols for quality assurance in the O.T. The Chief Surgeon should take personal interest in the training of theatre staff. All staff members should be trained in the maintenance of asepsis and universal precautions. Each member of the team including the junior most nursing staff and the sweeper should be put through progressive training to bring them to a level of efficiency so that they can carry out their duties more or less by reflex action or mechanically.

m.) A proper cleaning schedule should be made and followed.

n.) Transportation of patients from and to the ward should be organized by the anaesthetist at a suitable time depending upon the time of operation. For this

Purpose adequate staff should be made available permanently to the OT. To avoid unavailability of GDA to shift the patient to OT at scheduled time, a central pool of housekeeping staff should be made available to transfer patients in urgency.

o.) Realistic scheduling of procedures will avoid cancellation of operations. Potentially long operations should be identified and planned in such a way that it is possible to complete them within the time available.

p.) The doors of the O.T should be kept closed during the operations as the positive pressure of the O.T gets hampered.

q.) Phones inside the O.T should be working properly.

r.) Sufficient number of slippers should be there in the O.T and separate pairs of slippers must be used for toilet purpose.

s.) Chemical indicator slip should be put in the record for each case and should be checked.

t.) Proper disposal of biomedical waste as per rules, sharps should be in the sharps collector.

u.) There should be a system of communication with the O.T staff from outside the O.T, through call bell /intercom so that unauthorized/unnecessary entry in the O.T can be avoided and the sanctity of O.T can be maintained.

v.) The operating list should be made judiciously; efforts should be made to ensure that no case is postponed barring unforeseen and exceptional circumstances. Rigidity of "working hours" should not normally be allowed to come in the way of completing the list for the day. Other reasons for postponing operations such as non-availability of theatre linen, lack of sufficient instruments and inadequate preparation of patients should be reduced to the minimum by suitable administrative measures.

w.) O.T Committee: Since the O.T facility is used by a large number of surgeons of various specialities, maintenance of O.T discipline, effective coordination and efficient scheduling is always a big challenge for the chief of anaesthesia who

x.) generally is the Head of O.T department. All the quality and efficiency related issues can be sorted out through the medium of formal committee called the "O.T Committee" which can meet periodically to discuss various issues.O.T Committee should have representatives from all surgical disciplines and anaesthesia and may be chaired by the Medical Superintendent (MS).

CONCLUSION

Operation Theatre department is a very sensitive department where any infrastructural deficiencies or procedural lapses can seriously compromise the safety of patients leading to repercussions as serious loss of lives. Appropriate usage of operating room (OR) time can improve efficiency of utilization of resources and help to decrease surgical waiting lists.

Quality of services in O.T depends as much on the quality and reliability of equipments as on implementation of policies and working protocols based on universally accepted practices. It is equally important to ensure safety of patient through safe procedures and hazard free facilities. Above all, quality of services in O.T depends upon the standard of asepsis being ensured in the O.T.

High quality of services in O.T means carrying out the procedures without exposing the patients to any avoidable hazards so that the patient can have the best chances of recovery. O.T can be made a safe and hazard free place through a system of identification and elimination of risks. This can bring in rich dividends in form of patient satisfaction

and goodwill, a good image of hospital and matching increase in business.

As healthcare workers we have to believe that our main responsibility is to maintain our accountability and to deal with issues with a professional point of view. This project is an asset not only to the institution as a whole but to me in particular where it enriched my knowledge. Describing my project it is very important to conclude its significance for me, understanding all contributing factors, exchanging ideas with people, learning new strategies, failing at times, depressed at others, and successful at the end. The project opened my eyes to explore the interrelated functions and to analyze things at macro and micro levels. It expanded my ability to conflict resolution, problem solving, and decision making. Tackling such an important area as the operating theatre was an important decision and a challenging job since it is well known that operating theatres are the money generating areas in any private healthcare institution. I believe that quality of care in general will be improved by raising the bar for better practice, enhanced communications and captured indicators.

REFERENCES

Baulcomb, J.S., (2003). Management of change through focused force field analysis. *Journal of Nursing Management*, 11:275-280.

Butler, M., Boxer, E. & Sutherland–Fraser, S. (2003). The factors that contribute to count and documentation errors in counting. *ACORN Journal,* 16(1): 10-14.

Calms, S.H. & Shusterich, K.M. (1992). Operating room management: what goes wrong and how to fix it. *Physician Executives,* Nov-Dec Christian, C. K. (2006). A prospective study of patient safety in the operating room. *Surgery*, 139: 159-173.

Dexter, F. & Traub, R.D. (2002). How to schedule elective surgical cases into specific operating rooms to maximize the efficiency of use of operating room time. *Anesth Analg*, 94: 933-942.

Dexter, F., Wachtel, R. & Epstein, R. (2011). Event-based knowledge elicitation of operating room management decision-making using scenarios adapted from information systems data. *BMC Medical Informatics and Decision Making*, 11:2-13.

Dexter, F., Abouleish, A., Epstein, R., Whitten, C. & Lubarsky, D. (2003). Use of operating room information system data to predict the impact of reducing turnover times on staffing costs. *Anesth Analg*, 97: 1119-1126.

Dexter, F., Epstein, R., Traub, & Xiao, Y. (2004). Making management decisions on the day of surgery based on operating room efficiency and patient waiting times. *Anesthesiology*, 101: 1444-1453.

Dexter, F., Ledolter, J. & Wachtel, R. (2005). Tactical decision making for selective expansion of operating room resources incorporating financial criteria and uncertainty in subspecialties' future workloads. *Anesth Analg*, 100: 425-432.

Epstein, R. & Dexter, F. (2009). Economic analysis of linking operating room scheduling and hospital material management information systems for just-intime

inventory control. *Anesth Analg*, 91:337-343.

Gibbs, V., McGrath, M. & Russell, T. (2005). The prevention of retained foreign bodies after surgery. *Bulleting of American College of Surgeons*, 90(10):12-14.

Greenall, P. (2004). Managerial process: the reflective practitioner. *Leadership in Health Services*, 17(3): viii-xii.

HSE. (2009) Improving our services: a user's guide to managing change in the health service executives. Dublin.74

Joint Commission International Accreditation Standards for Hospitals, 4th Edition

Kotter, J. (1995 March–April). Change management; models and strategies: eight steps to transformational change. *Harvard Business Review*, 1-3.

Kotter, J. (1995, March–April). Leading Change, why transformation efforts fail. *Harvard Business Review*, 59-67.

Kotter, J. (1998). Winning at change. *leader to leader*, 10: 27-33.

Macario, A. (2010). Are your operating rooms being run efficiently? Medscape *Anesthesiology*.

Malhorta, V. (2006). What should anesthesiologists know about operating room management. *Revista medicacane de anestesiologisia*, 29: S83-S88.

McIntosh, C., Dexter, F. & Epstein, R. (2006). The impact of service-specific staffing, case scheduling, turnovers, and first case starts on anaesthesia group and operating room productivity: A tutorial using data from an Australian hospital. *International Anaesthesia Research Society*, 103: 1499-1516.

O'Neil, L. & Dexter, F. (2007). Tactical increase in operating room block time based on financial data and market growth estimates from data envelopment analysis. *Anesth Analg*, 104(2): 355-368.

Park, K.W. & Dickerson, C. (2009). Can efficient supply management in the

operating room save millions? *Current opinion Anaesthesiology*, 22: 242-248.

Plasters, C., Seagull, J. & Xiao Y. (2003). *AMIA symposium proceedings*, 521-528.

Shafer, S. (2006). Case scheduling for dummies. *Anesth Analg*, 103(6): 1351-1352.

Stanton, C. (2010, 30 December). Preparing tomorrow's perioperative staff today. Retrieved 30 December 2010 from www.aorn.org/news/managers/December 2010I issue/Staffing.

Voigt, T. (2000). Operation's performance improvement a technology solution. *Surgical Services Management*, 6(5): 15-21.

Wachtel, R. & Dexter, F. (2008). Tactical increase in operating room block time for capacity planning should not be based on utilisation. *Anesth Analg*, 106(1): 215-226.

Watson, D. (2006). Counting for patient safety. *AORN*, (6): 460-465.