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Reshambai Hospital , Ahmedabad

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A Report
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ABBREVIATIONS/ACRONYMS

ABHR- Alcohol Based Hand Rub

AC- Air Conditioner

ACH -Air Change per hour

AI-Artificial Intelligence

BN- British Standards Institute

Covid-19 – Corona Virus Disease of 2019

EDD – Expected Date of Delivery

EN- European Standardisation Organisations

ETO- Ethylene Oxide

FFP-Filtering Face Piece

FRSM- Fluid Resistant Surgical Mask

HFNO- High Frequency Nasal Oxygen

HCQ- Hydroxychloroquine

HRCT- High Resolution Computed Tomography

ICMR- Indian Council of Medical Research

IPD- Indoor Patient Department

KPI-Key Performance Indicator

NIOSH- National Institute for Occupational Safety and Health

OPD- Outdoor Patient Department

OT- Operation Theatre

PPE -Personal Protective Equipment

RTT- Referral-To-Treatment

SARS-Cov-2 – Severe Acute Respiratory Syndrome Coronavirus 2

SICP- Standard Infection Control Precaution

SOP – Standard Operating Procedure

Vit-C – Vitamin C

Vit-D – Vitamin D

MAIN TEXT

Reshambai Hospital is a comprehensive and state of the art ISO 9001 facility with maternity care , infertility-IVF, minimally invasive surgery ,Onco-Gynaecology , Radiology ,Pathology and fetal medicine department , NICU for sick newborn for personalized services to a woman.

Novel Corona virus (SARS-COV-2)is a new strain of coronavirus causing COVID-19, first indentified in Wuhan City , China. Pregnant women themselves do not appear to be more susceptible to the consequences of infection with COVID-19 than the general population . However , pregnancy itself alters the body's immune system response to viral infections in general ,and can occasionally be related to severe symptoms. Increased incidence of preterm birth due to corona infection and as there is increased perinatal anxiety , support for mental health is strengthened as far as possible . There is no evidence currently that the virus is teratogenic . Long term data is awaited.

As per the WHO report ,Corona infection may persist in community for 2 to 3 years atleast though pandemic may increase in intensity with rapidly increasing service demands till the development of herd immunity or invention of to newer drug and vaccine . But till then , to prevent spread of Corona infection in healthcare set up and taking care of hospital operations amidst corona pandemic will be the key to healthcare response in fight against Corona.

Managing hospitals in times of high risk of infection and low revenue is the biggest challenge that Hospital owners , CEOs face.

→Challenges a hospital faces are :

1. To keep abreast with changing SOPs/guidelines from the Govt/WHO/ICMR .
The situations are changing rapidly and so are the ways of dealing with it.
2. To process humongous data coming in through media , peer reviewed papers about positive cases , patients with co-morbidities , clinical manifestations ,deaths , recovery etc including countless anecdotal reviews.
3. To convince Doctors and Healthcare worker about rational use of PPE which is a precious commodity.

4. To retain our old patients . Though some hospitals might be communicating with patients over telemedicine ,messages etc .
5. To face revenue loss is the biggest challenge and maintain finances for day to day operations is a tough challenge.

→Principles of managing hospital during Covid-19 pandemic

Prolonged outbreak with the progressive spread of disease will increase service demands that can potentially overwhelm the capacity of the hospitals and health system at large .Prompt lockdown has slowed the spread but could not halt spread of disease.

Hospitals are complex and vulnerable institutions ,dependent on crucial external support and supply lines .Even a modest rise in admission volume can overwhelm a hospital beyond its functional reserve .However , due to Covid-19 pandemic ,inflow of patients has reduced .So managing a hospitals in times of high risk of infection and lower revenue is the biggest challenge a CEO would face.

To deal with Covid-19 pandemic , there must a Hospital Command System for the effective management of Hospital Operations. It should include representatives of Clinical , Human Resource ,Nursing , Purchase,Pharmacy,Laundry,Food and Beverage,Transport Department.

It must oversee:

(a)Continuity of Essential Services:

Essential medical and surgical care should be continued. Hospital should identify and maintain the hospital services that facility must provide at all times and under any circumstances.

Identify the resources needed to continue services.

(b)Communication:

The Hospital must designate a person to manage the flow of information from the Hospital to the Government/local authority and to the staff regarding quarantine rules,facilities made by the hospital ,decisions taken safeguarding the patients and employees .

(c)Surge Capacity:

It is the ability of a health service to expand beyond its normal capacity to meet increased demand for clinical care. We need to create a facility wherein our Healthcare workers are not at risk and patients are attended with caution.

(d) Human Resource:

Human Resource Department has to work hard to address liability, insurance, salary, leaves to the best of their capacity with maintaining trust of the employees. It is a challenge to devise duty rotations without overcrowding, arranging transport, managing food and beverages without putting anyone at risk. Group Medclaim policy for hospital employees is a good initiative to ensure health of employees.

(e) Logistics:

The management of supplies including pharmacy to be continuous and adequate. These are the times which will prove your relationships with the vendors

(f) Essential Support Services:

Food & Beverages, Medical Gases, Laundry, Transport, IT etc should be kept functional.

(g) Infection Prevention and Control:

The Hospital Microbiologist or Infection Control Nurse plays an important role in infection prevention, surveillance, training and rational use of PPE and biomedical waste management. Intervention should minimize the risk of transmission of infection to patients, staff and visitors. He should make them aware of hand hygiene and respiratory practices to contain infection. Visiting policy for relatives should be restrictive.

(h) Case Management:

Standard Operating Procedures/Protocols should be put in practice to deal with Covid-19 positive patients. National and International Guidelines should be followed. All staff must be aware of the guidelines.

(i) Surveillance:

Hospital should immediately take into consideration reports of unusual health events like clusters of cases, atypical clinical presentations occurring in and out of the facility. That data

should be made available to the public health authority to monitor the progression of Covid-19 and then plan accordingly.

(j)Laboratory Services:

Maintenance of the essential laboratory services is necessary for the appropriate clinical management . Establishing a laboratory referral pathway for the identification,confirmation and monitoring of Covid-19 is very important if hospital doesn't have an in-house RT-PCR testing facility.

→Specific Infection Control Practcies adopted in the hospital

Data for observational learning was obtained by observation ,face to face survey ,telephonic interview and from registers .

Corona virus has created a huge challenge for any healthcare organization . And, we all know that prevention is better than cure and in case of Corona infection, prevention is one and only sure shot to stay safe .Maternity care is the area where you have to exercise extra precautions as you are dealing with the lives of mother and fetus , both . During Corona pandemic , it is a good learning experience , how to provide hospital services with utmost care towards healthcare staff and patients .

As Corona has probable transmission from mother to fetus through placental circulation and amniotic fluid found to be infective as per one of the report published in the journal, it is imperative to exercise utmost care in dealing with corona positive or suspected patients.

Administrative controls implemented at an organizational level (e.g the design and use of appropriate processes , systems and engineering controls , provision and use of suitable work equipment and materials)to help prevent the introduction of infection and control transmission of infection in healthcare. Reshambai hospital had put SICPs in to practice and that was learnt as part of internship at Reshambai Hospital.

-Hospital had conducted informal videoconference meetings for to disseminate knowledge about Covid-19 amongst staff and make them aware about public health guidelines .

For to reduce risk to the staff and patients , resilience was built in to all staff rosters to allow for likely absence and sustainable staffing model was adopted .

Staff was made aware about changing guidelines by sending them research data online.

Signage were displayed at enterance and other assessment areas for instructing patients and staff.

To make staff aware about donning and doffing of PPE , mock drills for correct way of donning and doffing of PPE was conducted.

Staff above 60 years of age and those with any comorbidities like cardiovascular disease , diabetes mellitus , hypertension ,chronic lung disease ,cancer , chronic kidney disease were instructed to stay at home.

- Care for pregnant and postnatal women is an essential service and should be planned accordingly . Hospital had provided antenatal care as per routine .Any change / reduction in further visit done after consulting treating physician .Appointments arranged online via teleconferencing or video-conferencing .

All pregnant patients were advised to minimize social contacts as there is risk to mother and developing fetus also.

Payment of fees for OPD or other services were encouraged through online mode , cash transfer was discouraged.

Those who miss appointments due to isolation ,co-ordinator had made required arrangements as per the clinical condition of patient after isolation period .

For emergency or urgency , appointments were given after reviewing the case .In genuine emergency case was attended and in rest of cases appointment was differed.

Routine growth scans and routine investigations were told to be reduced .

During Corona pandemic , women were advised to attend clinic via private transport where possible . Ambulance services were provided on demand for those who needed it.

-All visitors , patient and one attendant were asked proper history and their temperature measured by digital infrared thermometer by hospital staff wearing FRSM to assess for infection risk on arrival at the care area .

All visitors were instructed to scrub hands with ABHR for disinfection of hands .Hand hygiene considered essential to reduce transmission of infection in healthcare settings .

Those with normal temperature and no history of cough , breathless , loss of taste-smell were allowed for OPD services with compulsory wearing of mask for patients and attendant.

Patients with sign and symptoms of Corona infection were referred to the designated covid hospitals of ahmedabad. Those whose EDD is not nearby -pregnancy is not near the term and if found to be with infection then was informed to the concerned authority and patient was admitted in medicine department of designated Covid-19 hospital .

- Non-clinical staff used surgical mask , full face shield and polycarbonate safety spectacles for protection against Corona exposure.

- OPD at Reshambai Hospital was segregated from other areas by closed doors.

OPD consultation was carried out after patient submit a prefilled form with chief complaints and associated problems to the treating doctor .Time duration of interaction between patient and doctor was kept as short as possible . Minimum distance of 4 feet between patient and doctor was maintained in OPD as a distance of approximately 3 feet (1 metre) around the infected individual has been frequently reported in the medical literature as the area of risk . In OPD and other areas , it was made compulsory to use disposable gloves and maintain hand hygiene after each patient contact .

Doctors used PPE kit including face shield and a transparent screen in between doctor and patient in OPD .Nurse posted in OPD also supposed to wear protective mask and full face shield/visor .

OPD based Transvaginal abdominal sonography was replaced with trans-vaginal sonography whenever feasible , to maintain distance between patient and doctor .

- All patients were attended by the staff wearing appropriate PPE and for admitted patients , visitors were not allowed to stay in the hospital premises .

No purse ,wallet , bag ,laptop ,watch ,mobile phone , hand or wrist jewellery allowed inside hospital , a separate room allotted to the staff for keeping such stuff .

Staff were told to change home clothes and wear hospital uniform after hand scrub. After hand wash and proper scrub staff was allowed to enter in hospital .

Staff with influenza like illness told not to come to work.

All non clinical staff were wearing N-95 mask (FFP-2) and spectacles .(mask has loose fit , while respirator has tight seal – N-95 mask have 95% efficiency in filtration of particles up to 0.3 micron size while FFP-3 respiratory has filtration capacity up to 99%).. All staff advised to wear mask certified by NIOSH.

Nursing station shifted to relatively open ,well ventilated area.

- For donning and doffing of PPE kits , isolation room had a separate PPE changing room .Strict hand hygiene measures were put in practice after removal of PPE ,equipment decontamination and waste handling.

All the staff used disposable gloves in the hospital while performing their duties .

Linen material used by any patient considered as infective and handled ,transported and processed in a manner that prevents exposure to the skin and mucous membrane of staff.

Uniform of the staff laundered separately from linen and other washable clothes .

-Those patients who developed Corona symptoms after admission as estimated incubation period 0-14 days , were transferred to designated Covid Hospital. Before transfer to Covid Hospital , such patients were kept in single room /segregated areas. Infection Control Personnel of Ahmedabad Municipal Corporation was informed for the same. In such cases , if newborn found corona negative then handed over to the relative who has not come in contact with patient.

-Hospital Staff were also inquired for any symptoms or exposure and checked for temperature before entering in to hospital premises . Social Distancing Norms were followed in maintaining duty roster .

Number of staff in Operation Theatre was kept at minimum to contain spread of infection if any .All staff were trained in the use and disposal of PPE so that 24 hour emergency theatre use is available without delay. Hospital policy was , if any patient develops Corona symptoms and diagnosed as Corona positive then all the staff caring that patient would be sent for 14 days quarantine with salary .Staff cohorting put in practice in the hospital that means the staff who care for one specific group of patients , for example emergency cesarean section were not allowed to move in between different patient cohorts. Staff was advised to take HCQ prophylaxis , Vit-C and Vit-D supplements.

-For to prevent spread in wards , patient beds were kept at distance and minimum of 6 ACH exercised .Movement of staff and patients , transport of patients was restricted . Waiting in to commuters area was restricted .

-All the pregnant patients posted for planned surgery were tested for nasal and pharyngeal swab test for Corona infection and negative patient were scheduled for the surgery . Those who were to be admitted for emergency surgery were kept in isolation room and their corona testing was done and sample sent to the laboratory.

-Management of patients to be admitted for delivery- All the parturients were instructed to come to the hospital five days before their EDD and then their Covid -19 test done , if test is negative then their labor process augmented by giving medicines . So, patient can be delivered and sent back to home as early as possible without getting infected or before they become

symptomatic if already have been infected before admission so that exposure to healthcare professionals and other patients is minimized.

All the patients under IPD were monitored for Corona symptoms , temperature monitoring and oxygen saturation.

-All the admitted patients were instructed for probability of getting infected even with due precautions and its consequences . Necessary permission obtained on the form of Informed Consent for chances of getting infected with Corona virus and its consequences.

All the staff involved with delivery process in labor room was under PPE. Labor room for the non infected corona negative parturients was kept separated from emergency labor room for conducting emergency delivery .

One OT was kept ready and separated from routine surgery as SOP for emergency surgeries . A large sign board was hanged outside emergency OT .In OT , centralized AC was not utilized instead , window AC system was utilized .

Separate Donning and Doffing area of PPE kit was kept near the scrub area.

In the OT,aerosol generating procedures like intubation , manual ventilation were practised less . General Anaesthesia was avoided during surgery and regional-spinal anaesthesia used to reduce spread of infection if any patient is false negative and asymptomatic.

Whenever general anaesthesia was used for emergency procedure ,Video Laryngoscope was used to intubate the patient which increased distance between the patient and anaesthesiologist . When general anaesthesia was used using ventilator , it was ascertained that there was no leak in the ventilator circuit as it increases chances of airborne infection .

All operation theatre procedures were carried out with a disposable , fluid repellent surgical gown ,gloves,eye protection ,PPE and a FFP-3 respirator as per BS/EN standards.

Anaesthesia Machine Ventilator was protected with a high efficiency filter to prevent cross infection to the patients. All monitors , machines , cautery system covered with transparent plastic and plastic removed and discarded after each surgery.

During surgery , talking should be kept at minimum whenever needed and sign language used to convey information.

For each emergency surgery at least 11 PPE kits kept ready for 2surgeons , 2 anaesthesiologist ,1nurse ,1anaesthesia technician , 1 pediatrician ,1 OT master ,1 bearer , 1 sweeper and 1 transfer team. Though only 1 surgeon and 1 anaesthetist had conducted procedure along with support staff .

During procedure under spinal anaesthesia , patient had to wear N-95 mask for to contain spread of infection .In the case oxygen was needed , oxygen mask was applied over N-95 mask over patients mouth and nose.

Aerosols generated from cauterization of the tissue was removed by a closed suctioning system .After each emergency procedure breathing circuit ,mask , tracheal tube,equipments were sent for ETO sterilization .After each surgery ,operation theatre was cleaned as per policy of infected cases . Surfaces cleaned with 2to 3% hydrogen peroxide spray disinfection ,1% sodium hypochlorite solution or wiping with 70% alcohol. OT was prohibited from use by staff or patient for another surgery after emergency operation atleast for 20 minutes after the patient leaves if patient conventionally ventilated with general anaesthesia.

-For requirement of blood transfusion during surgery , relatives of patient who were ready to donate blood were tested for Covid-19 infection and then blood donation was arranged.

Government had issued an advisory that ex-Corona positive patient can donate blood 28 days after last negative report and repeat Corona test before donation.

-Washable equipments should be used as general purpose detergent in a solution of warm water and then it should be disinfected in to 1:1000 Sodium hypochlorite solution . Sodium hypochlorite solution used to wipe out floors , tables , doors etc. Surgical instruments autoclaved as usual .

Hospital implemented policy of using disposable /single use equipment for patient care rather than reusable instruments after cleaning whenever possible .

-Patients posted for gynaecological surgeries for example hysterectomy etc were subjected to the Covid-19 testing and chest HRCT screening . HRCT screening is with high sensitivity and specificity for lung involvement in Corona infection , in addition to the routine precautions exercised. Patients who were manageable medically , surgical treatment was deferred to prevent patient overload and were called on later on date .

Infertile couples who sought advice/treatment for to conceive were given counseling of delaying pregnancy treatment because of Corona pandemic.

-Patients were served food prepared by the hospital kitchen under strict precautions and home made food was not allowed during stay at the hospital which restricted movement of the patient's relatives in to the hospital. Cafeteria staff was examined for their health screening , time to time.

-Waste generated in the hospital including used PPE kits , spectacles etc considered as clinical waste , presumably infective for Corona infection and waste disposed by local waste disposal team.

-Record keeping in the hospital and with service seeker is paramount . Electronic Record used for sharing the patient data and storage for the future retrieval ,paper use minimized to contain infection.

Project Report On How to improve Operation Theatre Efficiency

The managerial aspect of providing health services to patients in hospitals is becoming increasingly important. Hospitals want to reduce costs and improve their financial assets, on one 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, it has a major impact on the performance of the hospital as a whole. Managing the operating theatre is hard not only due to the conflicting priorities and the preferences of its stakeholders, but also due to the scarcity of costly resources. Moreover, health managers have to anticipate the increasing demand for surgical services caused by the aging population. These factors clearly stress the need for efficiency and necessitate the development of adequate planning and scheduling of procedures in Operation Theatre.

Name "operating theatres" has its origin in its history. At one time there used to be a table and all around raised chairs for students to see the operation. Those days surgeons wore street clothes with an apron to protect themselves from blood stains. Subsequently cleaner operation theaters came up with students' gallery at a height with glass partition between the operating room and student gallery.

(I) For efficient use of the Operation Theatre planning of Operation Theatre should be standard and as per standard ISO protocol.

*Objective of Planning Operation Theatre

- Design should aim to make patients feel at ease
- Facilitate efficient functioning
- Flexibility of use of the space
- Ease of cleaning the theatre – including the floor, walls, surgeons panel and any equipment such as pendants and theatre lights
- Ease of use of surgeons panels, theatre lights and pendants
- Use of natural light in patients' areas
- Patients' and staffs' safety
- Facilitate coordination of various services

- Regulate flow of traffic
- Minimize maintenance

Space Estimation

- Space requirement will depend on type of surgery to be performed
 - Analysis of the activities of each space
 - Equipment
 - Work space requirements
 - Zoning
 - Ergonomics
 - Staffing levels Patient and visitor volume
 - Communications
 - Life safety systems. Occupational safety systems
 - Heating, ventilation and air conditioning systems
 - Lighting; infection control, supplies
 - Shared facilities between two or more operating rooms and maintenance

Location

- Top floor of hospital was based on traffic
- Concept of having OT on top floor has changed
- Should be located near accident and emergency department and ICU
- The concept of 'nearness' has changed to 'nearness to vertical shaft'
- Accessibility to CSSD and investigative facilities

Zoning

Aims at Asepsis in Operating Room

- Protective Zone
- Clean Zone
- Aseptic Zone

- Disposal Zone

Protective Zone –

- Reception
- Waiting room for patients and relatives
- Change rooms for all medical and paramedical staff with toilets and lockers
- Transfer bay for patient, material and equipments
- Rooms for administrative staff
- Stores and records

Clean Zone

- Pre and post-operative rooms
- Stores and cleaner room
- Equipment store room
- Maintenance workshop
- Kitchenette (pantry)
- Emergency exits
- Office rooms for staff
- Close circuit TV control area

Aseptic Zone

- Operating room
- Scrub room
- Anaesthesia induction room
- Flash sterilisation of instruments

Disposal Zone

- Dirty utility room
- Disposal corridor

Various functional subareas of Operation Theatre

- **Reception:** For changing from street clothes to gown and to provide staff lockers and lavatories for staff.
- **Holding Area:** This area is planned for waiting and IV line insertion, preparation, catheter/gastric tube insertion, connection of monitors, and shall have O₂ and suction lines. Facility for CPR should be available in this area.
- **Induction Room (Anaesthetic Room):**
 - It should have all facilities as in OT
 - Provide space for anaesthetic trolleys and equipment
 - Located with direct access to circulation corridors and ready access to the operating room
 - Cleaning, testing and storing of anaesthesia equipment
 - Hand washing facility
- **Post Anaesthetic Care Units (PACU):**
 - Preferably adjacent to recovery room.
 - These should contain a medication station, hand washing station, nurse station, storage space for stretchers, supplies and monitors/equipment and gas, suction outlets and ventilator

Staff room: Men and women change dress from street cloth to OT attire; lockers and lavatory in close proximity are essential; rest room TV, etc. are desirable

Sanitary Facility for Staff: One wash basin and one water closet (WC) should be provided for 8-10

Toilet facilities in changing rooms is not acceptable

Offices

Rest Rooms

Laboratory

Seminar Room

Store Room

Theatre Sterile Supply Unit : Within this area, following are desirable -

-Temperature in range of 18⁰-22⁰ C, humidity of 40%-50% is the aim

- Air conditioned with 20 air exchanges per hour
- Storage of sterile drapes, sponges, gloves, gowns and other items ready to use
- Option to store in from one side and remove from other side
- Proper inventory provision and control
 - "Flash" steam sterilization was originally defined by Underwood and Perkins as sterilization of an unwrapped object at 132°C for 3 minutes at 27-28 lbs. of pressure in a gravity displacement sterilizer
 - Flash sterilization is considered acceptable for processing cleaned patient-care items that cannot be packaged, sterilized, and stored before use. Flash sterilization should not be used for reasons of convenience

Scrub Room:

- This is planned to be built within the sterile area
- Elbow operated or infrared sensor operated taps/water source is ideal
- It is essential to have non slippery flooring

Instrument Setup Room:

- Instruments are a potential source of infection, hence, some experts suggest that air pressure inside this place should equal to operating room or more than that

Operating Room

- The room size depends on the type of surgical use and economic consideration as the larger ones are costly to maintain in terms of air-conditioning
- Size:
 - Minimum 400 sq ft
 - For special procedures 600 sq ft
 - Space for Future Expansion
- Central Zone Centered Around the Table
- Parking Space : 36 Inches Wide Around the Walls for Keeping Equipment not of Immediate Use
- Circulation Space: Space Between Above Two
- Door of the OT should be 4-5 feet wide
- Sliding doors to prevent air disturbance

- Floor should be anti skid, impervious and easy to clean
- Wall finish should be seamless, Impervious and washable
- Ceilings should be smooth and impervious
- Joints between walls, ceiling and floor are to be watertight junctions.

Ventilation

- Laminar flow ventilation is used in modern operating theatres to reduce the number of infective organisms
- This is of particular significance in joint prosthesis surgery, where delayed and deep-seated post-operative infection may result in complications

OTs have been divided into two groups:

1. **Type A** (Erstwhile Super specialty OT): Type A OT means operation theatres for Neurosciences, Orthopaedics (Joint Replacement), Cardiothoracic and Transplant Surgery (Renal, Liver, Heart etc.).
2. **Type B** (Erstwhile General OT): This includes operation theatres for Ophthalmology, day-care surgeries and all other basic surgical disciplines

Both the group of OTs should have 20 air changes per hour , out of that 4 air changes should be of fresh air . Air velocity in the OT should be 25-35 FPM at the grille and positive pressure should be around 2.5 pascals . In Type A OT there should be less than 100 particles per cubic metre measuring 0.5 microns or larger with HEPA filter ceiling class 100/ISO class 5 , while in Type B OT there should be less than 1000 particles per cubic metre measuring 0.5 microns or larger with HEPA filter ceiling class 1000/ISO Class 6.

Validation of system- Every 6 months as per ISO 14644 standards. This should include:

- Temperature and humidity check
- Air particulate count
- Air change rate calculation
- Air velocity at outlet of terminal filtration unit / filters
- Pressure differential levels of the OT with respect to ambient/adjoining areas
- Validation of HEPA filters by appropriate tests.

(II) Technical View Points

The term "hospital utilization" denotes the manner in which a certain community makes use of its hospital resources. Various indices are commonly used in the assessment of hospital utilization, but no one of them alone can give a full picture of the utilization pattern. The different indices may be calculated on gross or specific basis. A gross index is an index expressing the overall average utilization for all types of hospital in the area. The specific index, on the other hand, expresses the utilization of a certain type of hospital or of a certain service within the hospital. Lot of literature is available on utilization of various hospital services such as out-patient services, accident and emergency services, radiological services, etc. but very few studies have been conducted on utilization of operating services. Operating room utilization is noted by using formula

$$URJ = \sum_{i=1}^n (\text{room clean} - \text{open sterile supply}) / (\text{RA stop} - \text{RA start})$$

(adapted from American Hospital Association) Where

URJ = room utilization, J = room number, Room clean = time room is ready for next usage. Open sterile supply = time first supply package is opened for that patients care. 1 = number of patients served. N = total number of patients in room J/day. RA stop = expected conclusion of surgery and end of day clean-up. RA start = expected time at which first case set-up may begin.

Utilization analysis

Utilization analysis involves surgical scheduling methods, instrument sterilization techniques, storage space utilization, equipment utilization and anesthetic procedures. Planning of surgical suite directly influences utilization of operation theater. Operating room utilization is calculated for the normal day starting and stopping hours. Utilization is measured on week days as night and weekend cases represent a separate issue. One hundred percent utilization/ day for particular operating room would be 8 hours/day. Few hospitals regularly achieve 100 percent operating room utilization. For hospitals performing a representative diversity of cases 80 percent utilization is considered acceptable. If the average case length is short, acceptable utilization may be 50 percent. Therefore utilization has to be viewed in context of other information available such as the average case length for the institution. The longer the average

case length the higher the expected utilization. Researchers found operating room utilization rates (operating time as a proportion of a notional 8 hours working day) to be low overall approximately 40 to 60 percent in widely varying settings. In one study classic utilization for each block-day by surgical subspecialty ranged from 44 to 113 percent. Average daily block-specific underutilization ranged from 16 to 60 percent whereas overutilization ranged from 4 to 49 percent. A study by Jan FA et al, showed theater utilization of 64.3 percent. Underutilization and overutilization are important measures because they may be used to evaluate the quality of OT schedules and the efficiency of OT utilization. In a study, time utilization of operating rooms in a large teaching hospital, the maximum utilization was found to be between 10 A.M. and 1 P.M. Delay was caused by surgeons resulting in the operating rooms remaining idle to the extent of 105 minutes on an average. Jan FA showed idle time of 128 minutes per day in OT. Unplanned scheduling of operations and late arrival of surgeons were the main causes. The classic definition of OT utilization needs to be improved. As encountered in the literature, classic utilization is defined as the ratio of the total OT time used to the total OT time allocated or budgeted. This definition of utilization is inadequate because it fails to differentiate the quality of utilization. Consider a simple example: a single OT is budgeted for 8 hours with two surgeries scheduled each of 4 hours duration. If the surgeries are performed consecutively within the budgeted work day, classic utilization is measured as 100 percent with no wasted resources. By contrast, consider the same OT when one 4 hour surgery is performed during regular hours and the other is performed entirely after regular hours. In the latter scenario there are 4 hours in which an expensive OT remains unused and 4 additional for which personnel must be recalled and overtime costs apply. Each scenario is an example of 100 percent classic utilization, but in the latter there is both under and over utilization, with penalties to the staff and institution inherent in each. Under utilization and over utilization as defined herein, are important measures because they may be used to evaluate the quality of OT schedules and the efficiency of OT utilization. In one study it was shown that out of the available time, 54 percent of time was spent on actual surgery, 31 percent for supportive services and 15 percent waiting while the operating room was being made ready for operation. Jan FA found 66.02 percent was spent on actual surgery, 21 percent on supportive services and 12.9 percent on making room ready for surgery out of the utilized time. In a study at University of California for each patient undergoing operation following times were recorded: OT ready, patient enters OT, anesthesia induction complete, surgery start, surgery end, patient leaves OT. It was observed that patients were brought into the OT just before the scheduled start time. Surgical incision was made 21 to 49 minutes after the patient was brought into the OT. Room turnover time (time from patient in

to patient out) was almost uniformly 36 minutes. Patient turnover time (time from end of surgery in one patient to end of induction of next patient) was generally 1 hour. The time between cases when no surgery was occurring was significantly longer than room turnover time because of the need to wake-up one patient and induce the following patient. With a well coordinated team minimal turnover time between operations can be accomplished; in an average time of 15 to 20 minutes the room will be ready for the next patient.

Scheduling strategy

Schedule efficiency- It is not a trivial matter to achieve a high level of utilization in the OT. The surgeon must give attention to schedule efficiency to contain costs. Surgeons should be aware that 100 percent utilization of OT time is unrealistic except when there are repetitive, uniform - length procedures. A regular utilization rate below 50 percent should suggest overstaffing, overbuilding or poor schedule management. Lessons from scheduling computer use can help make OT utilization more efficient. If a selective effective algorithm is used in scheduling, norms of utilization should be above 60 percent and peaks should exceed 75 percent. For efficiency of scheduling, all OTs should be completely modular and should be large enough to accommodate any type of surgery.

Block or scheduling

OTs in hospitals represent big investments and must be utilized efficiently. Sequencing procedures for operations within an operating room is important in this regard. Before managed care all available operating rooms were essentially staffed eight hours a day and procedures were booked on a first come, first served basis. Hospital collections for OT exceeded five times hospital costs, so there was little concern over how efficiently the OTs were scheduled. The primary goal was to provide as much care and surgical convenience as possible. As available OTs became filled with cases and surgeons experienced difficulty in booking elective cases, blocks of OT time were given to busy surgeons or surgical services. Because rewarding block time greatly increased surgeon satisfaction, hospital administrators felt pressure to grant it, especially if competing hospitals provided it. OT utilization is maximized by filling block time with as many hours of cases as possible. The key to maximizing OT utilization then is to determine: (i) the appropriate amount of block time to allocate to each surgeon and (ii) how to choose which day to schedule a patient for surgery?

Estimating case duration

Accurate predictions of OT times for surgical procedures are probably a prerequisite for matching OT suite workload to capacity. Wright and colleagues showed that the use of surgeons estimates can increase the accuracy of the commercial scheduling software to predict duration of surgery. Improvements in predicting case duration are of interest to hospitals because they may be able to produce cost swings. Improved operating room scheduling could reduce costs by reducing underutilization (operating rooms empty earlier than expected) and /or by reducing unplanned extension of the work day (operating rooms occupied later than predicted). The benefits of better scheduling would also extend to patients (i.e. reduce unnecessary waiting time). When no historical time data are available for a surgeon scheduling a procedure, the mean of the duration of cases of the same scheduled procedure performed by other surgeons is as accurate a method to predict case duration as are more sophisticated analysis. The goal of estimating case duration is to determine whether a case can fit into a "hole" (gap) in the OT schedule or whether an add on case will be completed within available time, then the maximum amount of time that a case is likely to require needs to be determined. The "upper predictive bound" specifies with a certain probability (e.g. 90%) that the duration of new case will be less than or equal to the bound. Upper predictive bounds measure the risk of an unusual and undesired event occurring (e.g. case runs over).

Sequencing cases

The OT manager can use statistical decision theory to sequence cases to decrease the impact of limitations in equipment or personnel on case scheduling. One study recommends that a surgical suite manager should consider a probability of 80 to 90 percent of no overlap being an acceptable risk in scheduling of cases.

Predicting surgical groups needs of block time

Block OT scheduling requires accurate forecasting of each surgical groups future need for OT time. A common approach to forecasting OT needs is to use the average of a surgical groups recent total hours of elective cases. Forecasting surgical groups need for OT time is necessary to ensure there is adequate staff available either to complete the work in a manner that minimizes labor costs or during regularly scheduled OT hours. It was found that total hours of elective cases over four weeks period can be normally distributed and unchanging overtime. Consequently an OT manager can use equations based on normal distributions to calculate the upper prediction bounds (upper limit) for total hours of elective cases. The average of the most recent two to four weeks period can be used to predict surgical groups future use of block time.

Effect of waiting time on utilization

How patients are scheduled into OT block time varies among surgical suites. Patient requests to be scheduled varies among surgical suites. Usually a patient needing surgery is given the first available surgical date for which the surgeon has open block time. Patient then wait to have surgery from the time they are given a surgical date until their day of surgery. Increasing the mean length of this waiting period decreases the week to week variability in the surgical groups work load. Surgical suites with longer average length of time that patients wait to have elective surgery are more likely to have accurate forecasts of workload. This is because surgical suits with longer average patient waiting periods will have more flexibility in finding the best date to schedule a case to match the expected case duration with the open block time that day.

Optimizing or utilization

The results of one study suggest that to optimize OT utilizations add on cases should be considered simultaneously at a cut-off time (e.g. 4 p.m. the day before surgery) and then scheduled based on scheduled duration from longest to shortest. In a study it was shown that staffing costs were lowest when the operating room manager did not incorporate surgeon and patient preferences when scheduling cases into over flow block time. Overflow block time is operating room time for a surgical groups cases that cannot be completed in the regular block time allocated to each surgeon in the surgical group.

Cost of cancelling a case

Under utilization and cancelling of the surgery leads to increased staffing cost for the hospital with inconveniency to the patient.

A study showed that cost of postponing a late day case is always greater than that of proceeding regardless of whether the costs were absorbed by patient, society or the hospital. It was concluded that a "zero tolerance for overtime" policy may be too rigid to be consistently cost effective. In any event every effort should be made to publish next day's operating list by 14.00 hour on day before surgery. Factors affecting utilization of operating room A number of factors affect utilization of operation theater. Most important ones of them are:

Theater layout

Theater layout directly affects utilization of operation theater. A centralized operation theater suite has many advantages in this regard as there is efficient use of staff and facilities, better supervision, vision, flexibility in scheduling operations and problem of supplies is simplified.

Operation list scheduling

Operating scheduling after the case duration has been estimated for every surgeon and for every type of surgery will prevent idle time and also overruns thus, improving utilization.

Level of care

The utilization will also depend on the level of the care a hospital is providing. In secondary care hospitals, the utilization may be less and the turn over of cases will be more as compared to tertiary care medical centers where the complexity of the case will affect the utilization (which will be more) whereas the turnover will be less, e.g. neurological, cardiovascular and plastic surgery cases consume more time.

Anesthetic practice

If anesthesia is given in separate room, the operating room can be used for more number of cases and number of the cases done will increase; increasing utilization.

Timing

The starting time of theater has direct effect on utilization. If there is any delay in starting a case utilization is going to be affected. Start time tardiness is the factor for under utilization of OT services.

Turnover times

Room turnover time, i.e. the time between one patient out and second in also affects utilization. Longer turnover time means decreased utilization.

Case duration

If case length is short utilization is less because, more time is wasted between cases than if case length is long.

Type of surgeries

In an institution where similar type of surgeries are performed utilization is expected to be more than in an institution where diversity of cases are done.

Canceling of surgeries

Canceling a case means no work for scheduled hours decreasing utilization. Therefore, cancellation of cases needs to be avoided by fully preparing the cases and by proper scheduling. Cancellation can be due to medical problems , full ICU facility ,unavailability of the staff or doctor mostly. As per 1 report 1 out of 10 scheduled surgeries gets cancelled . It varies for day care surgeries and indoor patient surgeries.

Supportive services

There should be no electric breaks, no faults in supply of anesthetic gases. Proper suction, equipment and sterilization facilities should be available.

Motivation of staff

There needs to be proper motivation of staff to do the job, they are expected to do. Cooperation between different staff members is a must for utilization of any facility.

Adequate staff

The number of surgeons, anesthetists, nurses and nursing aides also affects the utilization. The number of different staff members should be optimal.

(III)Managerial aspect of Operation Theatre Handling

OTs are at the heart of delivering quality outcomes for patients by performing life-changing and life-saving operations. That makes maximising the use of this vital and expensive resource essential for hospitals' efforts to meet quality, operational and financial targets.

However, while theatre efficiency is a broad and complex subject, five key levers can be used to drive sustainable change and improvement.

1. Robust Accountability and Governance

Clear support and accountability are needed to achieve a shared vision, and clinical leadership is essential in an overarching robust governance framework. All stakeholders must be aligned around a core set of KPIs. These performance measures also need to be understood, in the simplest terms, from the Theatres teams up to the Trust Board. For example, it can be hard to really understand what improvement in theatres' utilisation means in reality when expressed as percentages, but showing how many more patients have been treated is far more tangible, and more likely to create understanding and buy-in.

2. Better Alignment of Workforce to Demand and Capacity

Lack of demand and capacity plans, in our experience, is routinely the biggest driver of premium and temporary spend and failure to meet KPIs. However, demand and capacity planning is complex because the interdependencies across care settings (theatres, outpatients and wards) and performance against plans must be routinely monitored to ensure resources are optimised and supporting actions taken to realign the workforce. RTT adjusted model that explores these issues at specialty, sub-specialty and consultant level and enables hospitals to align capacity in a way that can be easily adjusted and monitored as priorities change.

3. Automated scheduling based on AI

Effective theatres rely on well-structured lists to avoid over-runs and under-runs but, all too often, organisational inertia and resistance to change means scheduling and booking patterns have gone unchanged and unchallenged for years.

AI can provide dedicated scheduling tools to build efficient lists and support the achievement of RTT by selecting appropriate cases. However, effective scheduling can only be achieved through direct clinical engagement. By applying this approach to scheduling, using evidence-based insight from data and clinical teams, NHS Trust Hospitals ,United Kingdom reduced early- and late-running theatre sessions by 105 and 30 hours per month respectively and delivered an extra 488 operations a year .

4. On the Day Problem-Solving

Plans change and the way teams respond to issues such as shortage of key equipment, limitations in staffing or beds, on the day - and in the moment - and learn from them is key. Improved feedback between the scheduling, operational and front-line teams is vital to tackle and learn from these. Equally, extra hands-on support (via consultancies) and a fresh pair of eyes can often deliver quick-wins and break down barriers to change.

5. Engaging Leaders with Insight

Engaging stakeholders with easy to understand insights from data is essential. Hospital Insights platform which provides an extensive range of key operational data in one place helped one to identify that late-starts were the key issue when the accepted belief across the hospital was that late-finishes were the main challenge. The tool allow to rapidly identify repeat offenders within selected specialities, and through a selected set of interventions agreed across the theatres teams, reduce late starts by 18%.

(IV)Conclusion

Leadership teams need to be asking if their organisation is tackling all five levers to give them the best chance of delivering sustainable performance improvement.

The decisions made by OT management should have a clear and definitive purpose in order to maintain consistency. In order of priority, governing principles of OT managers are to: (1) ensure patient safety and the highest quality of care; (2) provide surgeons with appropriate access to the OT (3) maximize the efficiency of operating room utilization, staff, and materials to reduce costs; (4) decrease patient delays; and (5) enhance satisfaction among patients, staff, and physicians. If OT management is properly performed ahead of time, all that doctors and nurses have to think about on the day of surgery is the patient. If management is poor, then the medical and nursing staff may waste efforts and resources to rush cases or juggle schedules, thus compromising attention to patient safety..

ANNEXURE:



