

Summer Placement
In
Kokilaben Dhirubhai Ambani Hospital, Mumbai

(April 1st to May 31st, 2015)

A Report

By

Dr. Paridhi Mehra

MBA Hospital and Health Management

2014-2016



Institute of Health Management Research, Jaipur

CERTIFICATE

This is to certify that Dr. Paridhi Mehra has undergone summer training at **Kokilaben Dhirubhai Ambani Hospital, Mumbai** from 6th April to 31st May, 2015.

The candidate has herself carried out all the studies related to the summer training. Her approach to the studies has been sincere, scientific and analytical. This summer training is a course requirement recommended before awarding the degree of Masters in Business Administration (MBA) in Hospital Management.

I wish her success in all her future endeavors.



Col. (Dr.) Ashok Kaushik (Retd.)
Dean (Academic and Student Affairs)
IIHMR University, Jaipur



Dr. Suresh Joshi
Professor
IIHMR University, Jaipur



Kokilaben Dhirubhai Ambani
hospital & medical research institute

Every Life Matters

To whomsoever it may concern

This is to certify that **Dr. Paridhi Mehra** has worked as an intern in Kokilaben Dhirubhai Ambani Hospital from 6th April, 2015 to 31st May, 2015.

During her tenure as an intern she has worked on the following case studies:

1. A Six Sigma Approach on Discharge Process Turnaround Time in Kokilaben Dhirubhai Ambani Hospital, Mumbai.
2. Lean Approach to reduce Report Turnaround Time in Imaging Department of Kokilaben Dhirubhai Ambani Hospital, Mumbai.

I wish her best of luck for her future endeavor.

Regards,

Dr. Mihir Dalal

Deputy General Manager

Kokilaben Dhirubhai Ambani Hospital

Mumbai.



Acknowledgements:

With immense pleasure I express my heartfelt gratitude to the Director of IIHMR Jaipur, Dr. S. D. Gupta, Dean Dr. Ashok Kaushik and my Mentor Dr. Suresh Joshi for giving me this opportunity to undergo training.

I am extremely indebted to all the professionals at Kokilaben Dhirubhai Ambani Hospital for generously sharing their knowledge and precious time which inspired me to do my best during summer training. I would like to thank Dr. Ram Narain (Executive Director), Dr. Mihir Dalal (Deputy General Manager, Clinical Administration), Dr. Ram Pandey (Senior Executive, Clinical Administration and Mentor) and Dr. Nilesh Gumardar (Clinical Administrator and Mentor) without whose help it would not have been possible for me to complete my project. I am highly grateful to all the staff of Inpatient Department and Imaging Departemnt for their cooperation which enabled me to complete my study in the department.

I am also grateful to all the department heads and staff for giving me time in spite of their hectic schedule .Without their active cooperation and participation it would not have been possible to accomplish my project successfully.

Table of Contents:

Abbreviations.....	05
Profile of Kokilaben Dhirubhai Ambani Hospital.....	06
Hospital Infrastructure.....	12
Departments in Hospital.....	15

Six Sigma Approach on Discharge Process Turnaround Time in Kokilaben Dhirubhai Ambani Hospital, Mumbai

Introduction.....	48
Literature Review.....	49
Purpose of Study.....	50
Research Objectives.....	50
Stages of Study.....	50
Results and Discussions.....	67
References.....	68
Annexure.....	69

Lean Approach to Reduce Report Turnaround Time in Imaging Department of Kokilaben Dhirubhai Ambani Hospital, Mumbai

Introduction.....	76
Literature Review.....	77
Purpose of Study.....	78
Research Objectives.....	78

Stages of Study.....	78
Conclusions.....	90
References.....	90
Annexure.....	92

Acronyms/Abbreviations:

- **A&E - Accident and Emergency**
- **HCA -Health Care Assistant**
- **ALOS -Average Length Of Stay**
- **CMD – Chief Medical Director**
- **COO – Chief Operating Officer**
- **CGHS – Central Government Health Scheme**
- **CSSD – Central Sterile and Supply Department**
- **CT – Computerized Tomography**
- **ECG – Electro Cardiogram**
- **TMT – Treadmill Test**
- **EEG – Electro Encephalography**
- **EMG – Electro Myography**
- **HOD – Head Of Department**
- **HRD – Human Resources Department**
- **ICU – Intensive Care Unit**
- **SICU- Surgical Intensive Care Unit**
- **MICU- Medical Intensive care Unit**
- **HDU-High Dependency Unit**
- **PICU-Pediatric Intensive Care Unit**
- **NICU-Neonatal Intensive Care Unit.**
- **IPD – In-patient Department**
- **KDAH – Kokilaben Dhirubhai Ambani Hospital**
- **MRD – Medical Records Department**
- **MLC – Medico Legal Case**
- **NICU – Neonatal Intensive Care Unit**
- **OPD – Out Patient Department**
- **TAT – Turnaround Time**

Profile of KDAH

The Institution

Kokilaben Dhirubhai Ambani Hospital & Medical Research Institute is India's newest, most advanced tertiary care facility. As the flagship social initiative of Anil Dhirubhai Ambani group, it is designed to raise India's global standing as a healthcare hub, with emphasis on excellence in clinical services, diagnostic facilities and research.

A vision to strengthen healthcare in the communities KDA Hospital serves and empower patients to make informed choices. Inaugurated in January 2009, The Hospital is a significant CSR initiative from Reliance Anil Dhirubhai Ambani Group. It is the only hospital in Mumbai to function with a FULL TIME SPECIALIST SYSTEM that ensures the availability and access to the best medical talent around-the-clock. The 750-bed hospital has over 103 full-time doctors, 520 nurses and about 200 paramedical and is growing every day.

It represents a confluence of top-notch talent, cutting edge technology, state of art infrastructure and most important, commitment. KDAH offers doctors and patient's cutting edge diagnostic and surgical solutions as well as the latest IT systems. In many cases, they represent the first of their kind in the region.

KDAH is fully geared in terms of talent, technology, structure and spirit-to reshape perceptions regarding hospitals and redefine the concept of caring. Indeed, this globally benchmarked institution marks the beginning of a new era in Indian healthcare.

History

The hospital project was initiated in 1999 by Dr. Nitu Mandke as a large scale heart hospital. Dr. Nitu Mandke was born in 1948 in a middle class family. He was first in the family to choose medicine as a profession with a determination to become a heart surgeon.

He joined B.J. Medical College; Pune from where he passed his M.B.B.S in 1970 came to Mumbai for further studies and completed his super specialty course in Cardiovascular Surgery. He spent close to 8 years working with world renowned figures in cardiac surgery like Dr. Magdi Yacoub in England and Dr. Kirklin and Dr. Pacifico at the University of Alabama in the United states. He was an all-rounder with exemplary proficiency in sports, arts, languages, mathematics and many more.

In his lifetime he won the heart of many and repaired many more through unerring surgery. He won various social awards like : The Rajiv Gandhi Gold Medal of Merit 1992, Indira Gandhi Sadhbhawna Award 1999, Outstanding Man of the 20th Century 2000, Pride of India 2001, Sarvashri Gold Medal 2000 and Maharashtra Gaurav Award to name a few.

With great passion Dr. Mandke built a substantial portion of the hospital building. Sadly his dream was cut short by fate when he succumbed to a massive heart attack in May 2003 ; leaving a dream unfulfilled and unfinished.

The Management of Mandke Foundation approached Reliance ADA Group, who graciously took over this project and developed it into one of the most modern and state of art multispecialty tertiary care hospital; naming the institution as – Kokilaben Dhirubhai Ambani Hospital & Medical Research Institute.

In honour of the initiator, the hospital's Medical Convention Centre has been aptly dedicated to the memory of Dr. Nitu Mandke.

VISION

We aim to be a global healthcare institution that combines the best in medical treatment with strong ethical principles and a culture of care and compassion.

VALUES

Integrity: To deal with all stakeholders – patients, partners, employees, vendors and the community – in the spirit of fairness and integrity

Transparency: To respect the patient's right to know at every touch point by providing information that is clear, concise, relevant and easy to understand.

Maximum Care: To re-evaluate every hospital system, process and procedure to ensure that patients and their loved ones receive maximum care and comfort.

Self - Improvement: To instil a process of learning and self - improvement at every level through continuous training, focused research and peer review.

Patient Dignity: To safeguard the dignity of patients by protecting their individuality and privacy at all times.

KEY STATISTICS

Encompassing ten lakh square feet of space spread over 17 floors and two basements. Its intelligent framework allows for hospital staff to optimize utilization of space and resources.

Accommodates over 750 inpatient beds, allows optimal utilization of resources and ensures privacy, dignity, comfort, convenience and the best healthcare to every patient with smooth and seamless movement of people & staff guaranteed.

Critical care unit has the largest number of critical care beds in Mumbai, with 130 ICU beds. Special technical features in ICU including ceiling mounted, dual arm pendants which ensure that the space around the patient is not cluttered. Another unique feature is dedicated air supply that keeps the critical care free of any kind of contamination and infection.

It has a total of over 140 Full time consulting clinics, with the capacity to handle over 6000 outpatient consulting every day.

Movements in the hospital is managed by 30 elevators – the largest elevator bank for any hospital in India capable of transporting 7500 persons per hour, with different elevators for inpatients , outpatients, staff and other services.

Two dedicated elevators ensure quick transfer of patients to operation Rooms and ICUs.

The hospital's laboratory is housed on a single floor spread over an area of over 40,000 square feet offers over 3000 routine and highly advanced diagnostics, genetic and molecular biology test.

UNIQUE IN MUMBAI

- ✓ Mumbai's first slice PET CT Scanner that combines computed tomography and positron emission tomography technologies into a single machine.
- ✓ 140 ICU beds, largest number of critical care beds in Mumbai.
- ✓ Hospital's laboratory housed on single floor, spread over an area of over 40,000 sq ft offers over 3,000 routine and highly advanced diagnostics, genetic and molecular biology tests.
- ✓ Mumbai's Largest OT complex with 22 operating theatres.
- ✓ Largest dialysis Centre in Mumbai.
- ✓ Full-time Specialist System: All doctors are attached and available only at Kokilaben Hospital.
- ✓ Level I Accident and Emergency Center.

UNIQUE IN INDIA

- ✓ Encompassing 10 lakh sqft of space spread over 17 floors and two basements. Its "intelligent framework" allows for hospital staff to optimize utilization of space and resources.
- ✓ Accommodates over 750 in-patient beds, allows optimal utilization of resources and ensures privacy, dignity, comfort, convenience and the best healthcare to every patient. However the smooth and seamless movement of people & staff guaranteed.
- ✓ Critical care unit has the largest number of critical care beds in Mumbai, with 130 ICU beds. Special technical features in ICU including ceiling mounted, dual arm pendants which ensure that the space around the patient is not cluttered. Another unique feature is dedicated air supply that keeps the critical care free of any kind of contamination and infection.
- ✓ It has a total of over 140 Full time consulting clinics, with the capacity to handle over 6000 outpatient consulting every day.
- ✓ Movements in the hospital is managed by 30 elevators – the largest elevator bank for any hospital in India capable of transporting 7500 persons per hour, with different elevators for inpatients , outpatients, staff and catering.
- ✓ Two dedicated elevators ensure quick transfer of patients to operation Rooms and ICUs.

- ✓ The hospital's laboratory is housed on a single floor spread over an area of over 40,000 sqft offers over 3,000 routine and highly advanced diagnostics, genetic and molecular biology test and will serve as a referral Centre for second opinions.

HOSPITAL INFRASTRUCTURE

a) Lower basement

- Biomedical Engineering
- CSSD
- MRD
- Nuclear medicine
- PET CT
- Radiation Oncology
- SRS

b) Upper basement

- Car Parking
- Central security office
- Mortuary

c) Ground floor

- Main Reception
- Admission counter
- Discharge and billing
- Pharmacy & Medical mall
- Gift shop
- Prayer hall
- Business centre
- Fine dining
- Food court
- ATM
- Central report collection centre
- Beauty Salon
- Accident and emergency

d) Mezzanine Floor

- Administration
- Library

- Staff dining
- e) First Floor
 - Clinical administration
 - Radiology & Imaging (X-Ray, MRI , Ultrasound, CT scan)
 - Health check up program
 - Sample collection
 - Centre for cardiac sciences
 - Centre for bone and joint
 - Centre for pulmonary and lung medicine
 - Multi-specialty OPD
- f) Second floor
 - Centre for children
 - Centre for brain and nervous centre
 - Dental clinic
 - Centre for cancer
 - Ophthalmology clinic
 - E.N.T clinic
 - Gastroenterology clinic
 - Dialysis centre
 - Blood bank
 - Urology clinic
 - Nephrology clinic
- g) Third floor
 - OT complex 1 (8 theatres)
 - Catheterization lab
 - ICU (Neurology and Surgical)
 - Interventional Radiology
- h) Fourth floor
 - IT Servers and Systems
- i) Fifth floor

- Ambulatory surgery
- Day surgery
- ICU (cardiac)
- OT complex 2 (7 theatre)
- Refuge Area
- j) Sixth floor
 - Rehabilitation centre
 - Convention and exhibition centre
- k) Seventh floor
 - IVF centre
 - Cosmetology and aesthetic surgery
 - Laboratory medicine and pathology
 - Nursing College
 - Tissue and bone bank
- l) Eighth floor
 - Birthing complex (labour and delivery)
 - ICU (paediatric and neonatal)
 - Birthing Suites
 - OT (obstetric)
 - Wards
- m) Ninth floor
 - Inpatients (paediatric and orthopaedic)
- n) Tenth floor
 - High dependency unit
 - ICU (Medical)
 - Refuge area
- o) Eleventh floor
 - General ward
- p) Twelfth to sixteenth floor
 - Inpatient

DEPARTMENT IN THE HOSPITAL

The following departments function in the hospital

Clinical Services	Clinical support services	Utility Services	Administrative services
Accident and Emergency	Laboratory	Ambulance services	Human resource Management
Outpatient Department	Imaging	Dietary Services	Material Management
Operation Theatre	Physical Medicine and Rehabilitation	Security	Marketing
Indoor Patient Department	Biomedical waste	Laundry and Linen	Financial Management
Intensive Care Unit	Medical Records	Housekeeping	Engineering Services
Nursing department	Pharmacy	Call Centre	IT Management
Dialysis	Blood Bank		Medical Social Work
	CSSD		
	Mortuary		

CLINICAL SERVICES

ACCIDENT AND EMERGENCY

An Emergency Department (ED) is also known as Accident & Emergency (A & E), Emergency Room (ER), Emergency Ward (EW), or Casualty Department is a medical treatment facility, specializing in acute care of patients who present without prior appointment, either by their own means or by ambulance. Due to the unplanned nature of patient attendance, the department must provide initial treatment for a broad spectrum of illnesses and injuries, some of which may be life threatening and require immediate attention.

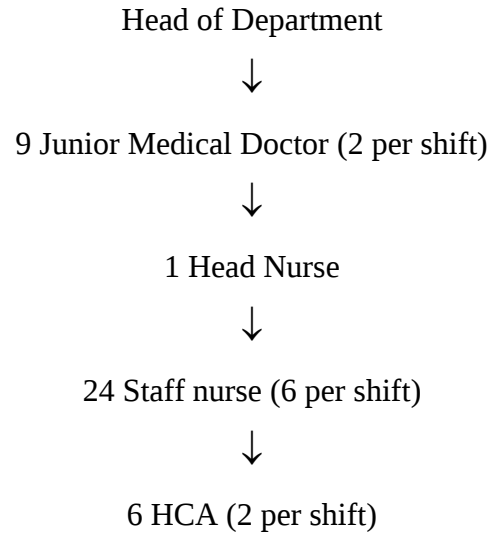
Layout

- 11 bedded (6+3 triage + 2 isolation)
- Each bed is separated with curtains to maintain patient privacy and is equipped with the following:
 1. Oxygen supply
 2. Suction Pump
 3. Syringe pump
 4. Cardiac monitor

Minor Operation theatre

- Machines in minor OT are as follows:
 1. Anesthesia machine
 2. ETCO2 machine
 3. Cautery machine
 4. OT table
- Procedures done in minor OT
 1. Lumbar puncture
 2. Biopsy
 3. Bone marrow aspiration
 4. Suturing

This department has got its own billing and discharge counter.

Staff:**Equipment:**

- Defibrillator - 2
- Portable ECG - 2
- Nebulisation machine -2
- Portable sonography machine -1
- Trolleys :
 - ✓ Procedure trolley
 - ✓ Induction trolley
 - ✓ Adult crash cart
 - ✓ Dressing trolley

Ambulance:

There are 2 types of ambulance:

- a) Non-cardiac ambulance
- b) Cardiac Ambulance

Equipments in the ambulance are as follows:

- Ambulance cot
- Portable Ventilator (cardiac ambulance)
- Portable oxygen unit
- Portable suction unit
- First aid kits
- Traction splint
- Auxiliary Stretcher
- Transfer sheet
- Airways (nasal, oropharyngeal)
- Obstetrical Kit
- Sphygmomanometer
- Stethoscope
- Fire Extinguishers
- Burn Kit
- Others
- ✓ Sterile and non-sterile gloves
- ✓ Face mask
- ✓ Blankets
- ✓ Towels
- ✓ Bed pan
- ✓ Tongue depressors
- ✓ Cold packs instant chemical type

Staff:

- 1 HCA in non-cardiac ambulance
- 1 HCA + 1 nurse + 1 cardiac consultant in cardiac ambulance

OUTPATIENT DEPARTMENT

Kokilaben Dhirubhai Ambani Hospital has 140 independent consultant clinics with a capacity to handle over 6000 outpatient consultations every day. These clinics are organised as “functional clusters” representing a specialty, with each cluster containing its own examination room, phlebotomy room, and in instances, rooms for specialized medical equipment unique to the cluster. A day care dialysis unit, an endoscopy theatre complex, radiology suites and a blood bank support outpatient service are co-located on the same floors as the self-contained outpatient area. The hospital outpatient services offer specialist consultation services across 42 different specialties including six centers of excellence.

The six centre of excellence are as follows:

- Centre for neurosciences
- Centre for cancer
- Centre for physical medicine and rehabilitation
- Centre for cardiac sciences
- Centre for bone and joint
- Centre for children

The specialists included are Anesthesiology, Critical Care Medicine, accident and emergency, gynecology and obstetrics, imaging, laboratory medicine and pathology including biochemistry, molecular biology, hematology, histopathology, microbiology, clinical pathology, transfusion medicine and blood bank, genetics, tissue and bone bank, dermatology, endocrinology, gastroenterology, clinical nutrition, internal medicine, nephrology, psychiatry, pulmonary medicine, rheumatology, geriatric medicine, surgery including dentistry, ENT, general surgery, ophthalmology, plastic and reconstructive surgery, urology, surgical oncology, cosmetology.

a) Access to OPD services:

All patients who visit KDAH or free OPD for the first time for consultation/ other services are issued a card which gives each patient a UHID number. This UHID card is attached to the

registration form. With the help of this number, medical records of patients can be assessed. Allotment and control of UHID number is the responsibility of the admission staff desk.

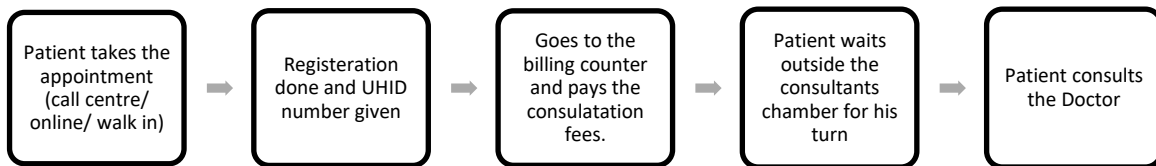
b) OPD Appointment:

Appointments can be fixed over telephone to all from the call centre or personally across the reception counter. Fax and e-mail facilities are also available.

c) OPD Tariff:

The OPD consultation fees is Rs. 1000 which is valid for 48 hours and for each subsequent visit within one month the patient has to pay Rs. 700. OPD consultation fees for premium doctors is Rs. 2000 valid for 48 hours and Rs. 1500 for all subsequent visits within one month.

d) Process Flow:



Following services are offered in the OPD:

- Medical / Surgical consultations
- Preventive Health check-up packages
- Laboratory investigations
- Imaging services
- Cardiology investigations
- Neurology investigations
- Pulmonary investigations
- Pain management
- AKD
- Gamma knife
- Endoscopy
- Bronchoscopy
- Urodynamic study
- Physiotherapy

- CDC
- ENT
- Ophthalmology
- Dental procedures
- Oncology
- Radiation oncology

HEALTH CHECK UP

- The executive check-up department, a part of OPD services, is a wing of this multispecialty hospital dedicated to the diagnostic and preventive side of patient care. It is a place where healthy patients come for prognosis of disease or to know about the preventive and curative aspect of conditions they may already have.
- This system facilitates the patient to get all the required investigations/consultations done without having to pay for either consultation and/or for each individual item of pathological or imaging investigation. It is the centre point where the potential customers come directly in contact with hospital services. This department can therefore be a point to draw in patients to become in-patients or for them to come even for follow up OPD consultation.
- The packages in the program have been developed by a team of highly qualified and experienced medical personnel and are designed to offer a complete medical check-up and within their limitations detect any latent health problems. In addition, these packages are offered at special discounted rates that make them truly worthwhile. At the end of the day, candidates leave the hospital with all their reports.
- This department is dependent on various other hospital departments and consultants to ensure a smooth process flow. Therefore co-ordination is a key factor in smoothly running the department. The departments in co-ordination are: pathology, radiology, cardiology, ENT, ophthalmology, dental etc. the visiting consultants are from following department: medicine, surgery and gynecology.

OPERATION THEATRE:

The aim of department of anesthesiology and OT facility is to provide the highest quality of care to patients undergoing various types of surgeries. The OT facility is positioned as a tertiary care centre of excellence providing complete services for various surgical specialties.

The total number of OTs in the hospital is 22 out of which 19 are functional and are located on 3rd, 5th, 7th and 8th floor spread over an area of 600 square feet. There are eight OTs on the 3rd and 5th floor, two on the 7th floor and one on the 8th floor. The cases are distributed based on the capacity of each OT.

The department is staffed with highly experienced and trained anesthesiologist, surgeons, technicians, nurses and other support staff. Their services have state-of-the-art technology and equipment with highest level environment and quality controls. For each OT there are one scrub nurse and one circulating nurse. Protocols based on approach for quality pre-operative, intra-operative and post-operative and follow up care of the patients.

Pre and Post Operative areas are demarcated on each floor. The OT complex handles around 40-45 cases each day. Cleaning of each OT is done between cases and fumigation is done at the end of the day.

Complete services to the following surgical specialties are provided.

- Cardiac surgery
- Neuro surgery
- Onco surgery
- Orthopaedic surgery
- General surgery
- Gynecology and obstetrics surgery
- Pediatric surgery
- GI surgery
- Uro surgery
- Plastic surgery

- Ophthalmic and ENT surgery
- Transplantation surgeries

IN PATIENT DEPARTMENT

The IPD provides the detailed pre-procedure needs their completion and coordination with the diagnostic to arrive at the diagnosis and completion of treatment regimens, comprehensive care in the pre-operative and follow up care, rehabilitative, and nutritional regimen and their scientific amalgamation as per the progressive patient care need. IPD wards are located on floor numbers 9,10,11,12,13,14,15 & 16 The IPD rooms are of the following types: single room, twin sharing, deluxe room and suits. Each floor has three zones, east, west and central and each wing has a separate nursing station. The various types of rooms with their features as follows:

- **GENERAL WARDS**
 - 5beds/room
 - Air conditioned
 - Bed head panels with medical gasses
 - Nurse call systems with 2 way communication
- **SINGLE ROOMS**
 - Area of 320 sq.ft
 - Separate patient zone and attendant zone
 - Nurse call system with two way communication
- **Twin Sharing**
 - Bed head panels with medical gasses
 - Television sets
 - Couch for each patient relative
 - Nurse call system with two way communication

- **Suits**
 - Area of 750 sq. ft.
 - Terrace garden
 - Exclusive visitor area and guest rooms
 - Nurse call system with two way communication

The nurse: bed ratio is 1:5 for general ward, 1:2 for single rooms, 1:3 for twin sharing, 1:1 for suits. The various other rooms are clean utility, dirty utility, janitor room, AHU (air handling unit), sluice room, I.T. room and service elevator.

INTENSIVE CARE UNIT

The ICU cater to patients with most severe and life-threatening illnesses and injuries requiring constant close monitoring and support from specialist equipment and medication to ensure normal bodily functions. There is Adult ICU consisting of SICU & MICU, Paediatric ICU, Neonatal ICU, Transplant ICU and Paediatric Cardiac ICU. The nurse patient ratio for critical patients is 1:1 and for stable patients is 1:2. The ICU co-ordinates with CSSD, Laboratory and the Radiology department. Strict aseptic techniques are used. Pressure zones are created to control infection rate.

The ICU has highly dedicated and trained medical, nursing and allied staff. There is a system of closed ICU in KDAH .The space per bed is 320 sq feet in the patient care area

Bed Capacity in each ICU:

ICU	BED CAPACITY
SICU 1	11
SICU 2	10
PCICU	11
PCICU-HDU	2
PICU	7
TRANSPLANT ICU	7
NICU	8
NICU-HDU	5
MICU	28

MICU	25
------	----

Human resource of the ICU:

- Intensive care doctors
 1. 1 Chief Intensivist for all ICU
 2. Junior consultants (12 hour shift)
 3. Clinical registrars (8 hours shift)

- Intensive care nursing staff
 1. 1 Director General Manager for ICU
 2. Nurse in charge (8 hours shift)
 3. Team leader (8 hours shift)
 4. Senior nurse officers
 5. Junior nurse officers

- Allied staff
 1. Physiotherapists
 2. Dieticians
 3. Biomedical Engineers
 4. Health Care Assistants

Shift timings:

For doctors

- ✓ Morning : 8 am - 4 pm
- ✓ Afternoon : 2 pm - 10 pm
- ✓ Evening : 10 pm - 8 am
- ✓ Overlapping hours : 2 pm - 4 pm

For nurses, HCA and housekeeping staff

- ✓ Morning : 7 am - 3 pm

- ✓ Evening : 3 pm - 11 pm
- ✓ Afternoon : 11 pm - 7 am

Visiting hours: 11 am – 1 pm and 5 pm – 7 pm

- ✓ Only 1 relative at a time is allowed

Records and Registers

- Admission and discharge register
- Handing and Taking over/Team leader sheet
- Assignment book
- Leave book
- O.T booking register
- Critical care flow sheet
- Narcotic drug register.

Equipments:

MONITORING EQUIPMENT	CARDIOVASCULAR THERAPY	RESPIRATORY THERAPY	LABORATORY EQUIPMENT
Bed side and Central Monitors ECG Recorder Pulse Oximeter Spirometer ECG Monitor Temperature Monitors Blood Glucose Meter	CPR Trolley Defibrillators Infusion Pumps and Syringes	Ventilators Intubation/ Tracheotomy Trolley Nebulizers	Blood gas Analyzer Electrolyte Analyzer

Miscellaneous Equipments:

- Crash Cart
- Dressing trolley
- Procedure trolley

ICU	LOS (days)
Adult ICU	4
PCICU	6.5
PICU	5.6
NICU	6.4

PAEDIATRIC INTENSIVE CARE UNIT

The PICU looks after all critical pediatric patients. It is located on 8th floor. The ICU is split into 2 zones for outpatients and inpatients. The various other rooms include Ante room, equipment room, clean utility and dirty utility room. The average length of stay of each patient is approximately 1 week.

NEONATAL INTENSIVE CARE UNIT

The NICU is 18 bedded and located on the 8th floor. The department is divided into 2 zones – outpatients and inpatients. There are 2 isolation rooms. The nurse ratio is 1:1

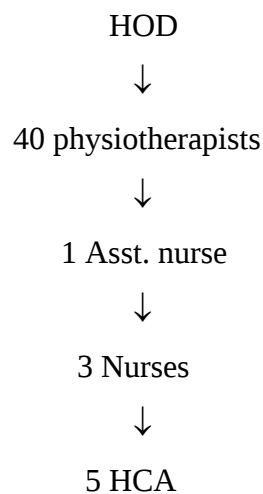
DEPARTMENT OF RADIATION ONCOLOGY

The department of radiation oncology at KDH is a state of the art unit having the latest technology and equipped personnel, delivering services of international quality. The department has the first installed TRILOGY and NOVALIS Tx in the country. It is capable of performing all the high end treatment like IMRT, IGRT intracranial stereotactic radio surgery and radiotherapy, extra cranial stereotaxy, total body radiation, total skin electron treatment. There is a facility of brachytherapy for all sites in the form of remote

afterloadingHDR brachytherapy system with 3D planning facility. The department works in close coordination with surgical oncology and neurosurgical subspecialties' (e.g. head and neck, thoracic, breast, urology and gynae oncology, neuro-oncology) maintaining a high quality evidence based practice for the particular sub suite.

CENTRE FOR REHABILITATION

- The centre is located on a dedicated floor with 30,000 square feet area and exclusive inpatient service, first of its kind.
- The department is located on 7th and 8th floor of hospital.\
- It has got its own billing desk.
- It also consists of a day-care centre for those patients who need 4-5 sessions in a day.
- **Staff of the department consist of**



- **Following therapy services are available :**

1. Neurological Rehabilitation
2. Musculoskeletal rehabilitation
3. Cardiac Rehabilitation services
4. Pulmonary Rehabilitation
5. Pediatric Rehabilitation
6. Cancer Rehabilitation

7. Pain management
8. Women's health
9. Geriatric Rehabilitation

The therapy services offered in the department:

- 1) Physical therapy
- 2) Occupational therapy
- 3) Electrotherapy
- 4) Speech and language pathology
- 5) Exercise physiology
- 6) Psychology
- 7) Rehabilitation nursing
- 8) Orthosis and prosthesis

IVF CENTRE

- Centre for reproductive endocrinology and fertility (CREF) is located on the 7th floor of the hospital and has dedicated space for out-patient care and day care of patients with infertility and reproductive endocrine problems, and for medical acupuncture and mind body program.
- CREF is staffed by a full time consultant reproductive endocrinologist and infertility specialist, embryologist and infertility issues and a health care assistant.
- A full-fledged laboratory and radiology department offering a comprehensive range of tests including some newer cutting edge tests under one roof only compliments our services at CREF, but is also extremely convenient for patients.
- Medical conditions addressed at CREF:
 - ✓ Reproductive endocrinology
 - ✓ Midlife health care
 - ✓ Bone health
 - ✓ Adolescent gynaecology
 - ✓ Infertility treatment
- Fertility drugs to induce / enhance ovulation (pills or injections)
- Intrauterine insemination

- Assisted reproductive therapy (ART) procedures:

- In vitro fertilization (IVF)
- Intracytoplasmic sperm injection (ICSI)
- Assisted hatching(AH)
- Blastocyst transfer
- Pre-implantation genetic diagnosis (PGD)
- Embryo cryopreservation
- Sperm cryopreservation
- Testicular tissue cryopreservation
- Third party reproduction

- Donor oocytes

- Donor sperm

- Gestational surrogacy

- Donated embryos

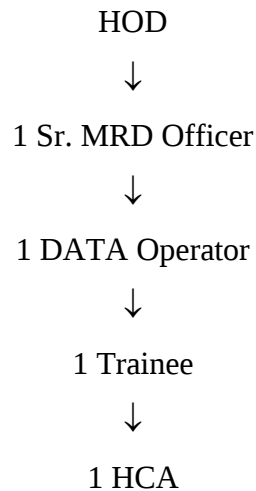
Other facility:

- ✓ Diagnostic tests
- ✓ Billing and registration
- ✓ Phlebotomy services
- ✓ Ultrasound facilities
- ✓ Andrology and embryology laboratories
- ✓ Operating room, pre-op and recovery room facilities
- ✓ Counseling and support services

CLINICAL SUPPORT SERVICES

MEDICAL RECORD DEPARTMENT

- The main functions of the department are :
 - 1) Storing file for future reference.
 - 2) Research.
- Staff:



- Open and close audit is done of all files before keeping them storage.
- The arrangement of files is done in following ways-
 - Year wise and UHID wise.
 - Also on the basis of their type :
 - a) Regular files
 - b) DAMA files
 - c) MLC files
 - d) OT recovery files
 - e) Chemotherapy files
 - f) Dialysis files
- Apart from files few forms and records are also store in this department:
 - Consent form
 - OT papers

- A&E papers
- Certificates issued from the department :
 - Patient fitness certificate
 - Fit to fly certificate
 - Leave certificate
- All files are stored in the department for the following time period:
 - Reports -1.5years
 - Death, DAMA & MLC files 20 years
 - Regular files-5years
- ICD-10 coding is done for storing files:
 - Red-Death, DAMA & MLC
 - Black-Oncology
 - Yellow-Gynecology& obstetrics, IVF files
 - Dark blue-General medicine, critical care, Nephrology, Endocrinology, Gastroenterology, Pulmonary medicine, Dermatology, Dental, Psychiatry, rehabilitation, Rheumatology.
 - Light blue- Pediatrics
 - Orange- Neurology, CVTS, Cardiology, orthopedics
 - Green-ENT, general surgery, ophthalmology, Urology, Cosmetology, Interventional radiology.
- This department has to notify Bombay Municipal Corporation(BMC) about following things on regular basis:
 - Birth and death report (once in a week).
 - Notifiable disease which includes cholera, dengue, plague, yellow fever, TB, polio, meningococcal meningitis, leptospirosis, viral encephalitis (once in a week).
 - Maternal mortality (once in a month)
 - MTP &PNDT (once in a month)
- Retrieval- for easy retrieval of files tracer cards are used when files are given to patients or sent outside the department.

LABORATORY

The salient features of the department are as follows-

- CAP (College of American Pathology) accreditation
- Central processing laboratory is spread over 40,000sq. Ft. which follows strict internal quality compliance for all analyzer.
- Exhaustive menu of tests from routine to esoteric.
- Excellent laboratory management system which handles both pre-analytical and post-analytical aspects.
- Dedicated courier and logistic services
- 24 hrs. sample collection facility
- Stringent quality control monitoring which satisfy the quality assurance elements elaborated by GLP and GCP and readily available documented evidence of quality assurance and quality proficiency schemes.
- Constant improvisation and technology innovation using over 150 state of the art equipment.
- Quality control and quality assurance executive that monitors pre-analytical and post-analytical processing of the samples.
- Customized management report (MIS-management information system)
- An active IRB and ethics committee which oversees clinical trials proposed when required.

BLOOD BANK

Transfusion medicine is a multi-disciplinary area concerned with the appropriate use of blood and blood components in the treatment of human disease. The mission of KDAH is to make available appropriate adequate quantity and high quality of safe blood and blood component to “anyone, anytime, anywhere” in medical community. KDAH adheres to quality norms and focus on the donor satisfaction standards and technique and quality control are precisely and meticulously maintained as per norms given in the drugs and cosmetics acts, by the regulatory authority, director drug controller (India), ministry of health and family welfare, Govt. of India, and also internationally recommended methods. The department runs round the clock and blood and its products are supplied as and when requested. Blood donation is accepted from voluntary blood donors and relatives and friends of the patient. Autologous blood donation (blood donation for one’s own use) is also accepted. The blood donors are

informed and educated about the infections transmitted by transfusion of blood components. 100% of collected blood is processed into component like red cells concentrate, platelet concentrate, fresh frozen plasma (FFP) and cryoprecipitate. The use of the components is better and cost effective. The blood bank at KDAH is equipped with state of art equipment, which enables use of advanced techniques for processing/screening of blood and its components. All the mandatory screening for the transfusion transmissible disease like HIV, HBV, and HCV is done with the more sensitive and specific CMLIA and ELISA methods. All units are screened for VDRL and malaria parasite. Red cells in an additive solution (RCA) like, SAGM or ADSOL is a product which is used in variety of indication like surgeries, anemia, trauma, child birth etc. as a thumb rule one unit would increase the hemoglobin by 1 gm.%.

IMAGING

The imaging department consists of radiology services. The investigations performed in these departments include:

- CT Scan
- MRI
- X-Ray
- Ultrasonography
- Mammography

The HIS has a system for appointment scheduling for each of these investigations. The appointments are given by Call Centre. There are 4 X-ray machines, 5 ultrasonography machines, 1 mammography machine, 1 CT Scan machine, and 2 MRI machine of which one is 3 Tesla located in the radiology department and the other is 1.5 Tesla IMRIS (intraoperative magnetic resonance imaging suit) is a movable machine attached to the ceiling that is located in the OT. It is basically used for MRI scanning during a surgery. They are working on its complete utilization.

CENTRAL STERILE SUPPLY DEPARTMENT

The central sterile supply department (CSSD) plays a key role in providing the items required to deliver quality patient care. Centralizing the reprocessing of reusable devices helps ensure uniform standards of practice, while also providing for improved workflow (soiled, to clean, to sterile). This also facilitates the training and education of skilled technicians who must be aware about the standards, complexities, challenges, risks and technicians associated with the CSSD function. Every CSSD task must be performed for the welfare and safety of patients, co-workers and the community.

CSSD is the heart of hospital infection control and the most important unit of clinical support services. CSSD's main functions are cleaning and drying, assembly, packing, sterilizing, storing and distributing instruments (both multi use and single use devices), as per well delineated protocols and standardized procedures.

INFRASTRUCTURE

It is divided into 3 zones:

1. Decontamination area
2. Assembly area
3. Sterile storage area

STAFF

1 manager / department head

1 executive

1 senior technical officer

4 technical officers

6 junior technical officers

10 trainees

16 health care attendants

MAJOR TECHNOLOGIES:

- Ultrasonic cleaner
- Washer disinfectant
- Dryer
- Steam sterilizers
- Plasma sterilizer
- ETO (ethylene oxide gas sterilizer)
- Dry heat sterilizer.

RECORD MAINTAINED:

- Manual issue and receiving OT
- Manual issue and receiving all departments
- Sterilization records

PHARMACY

Central pharmacy indents to IP, OP and LB. It is of 2 categories:

- Capital
- Consumables.

SCOPE OF INVENTORY MANAGEMENT:

- INDENTATION
- RECEIVING
- STORING
- DISTRIBUTION

The staff consists of:

- 5 manager
- 1 executive

- 8 senior officers
- 24 officers
- 7 junior officers
- 6 trainee assistants
- 1 trainee HCA
- 16 attendants
- 21 HCA

HOUSE KEEPING:

The objective of housekeeping is exceptional standards of cleanliness, sanitation and hygiene of the entire hospital. Housekeeping services are outsourced to ARAMARK services.

The staffs include:

- Housekeeping manager
- Assistant manager
- Housekeeping executives
- Supervisors
- Houseboys & house girls

Functions of housekeeping department are:

- General facility cleaning
 - Routine cleaning of patient's rooms
 - Patient's common areas
 - Washrooms
 - OT
 - Laboratory
 - Consultant's office
 - Glass windows and doors
 - Ceiling etc.
- Handling of biomedical waste.

- Pest control-It includes spraying every 24 hours for mosquitoes, cockroaches, flies, rats, lizards and termites.
- Garbage disposal- The housekeeping staff collects garbage collected in specified color coded bags from all garbage bins existing inside the hospital premises and disposes the garbage at the designated area within the hospital, which is the biomedical waste room. The general waste is sold to the junk dealer and healthcare waste is handed over to government approved vendor “synergy waste management”.
- Horticulture- It is responsible for maintenance of in house plants & terrace gardens, flower arrangement during hospital functions.

The performance indicators are B.M.W. color code compliance, B.M.W. collection, pest control efficiency and sanitization of the hospital premises.

CLINICAL ADMINISTRATIVE SERVICES

STORES

Material stores functions in order to supply the right material in right quintiles at the right time at the right price. The IP departments put up requests for the required materials by uploading indents in the HIS. The store manager raises a purchase order to be sent at the central procurement stores. The supplies received are inspected on the basis of quantity and expiry in the incoming material inspection area. The items are stored as per the storage norms. Departmental issues are made for non – medical consumables as per requirement. Stock is reviewed periodically for non-moving items and short expiry items. Stock audits are carried out twice/year. Any variance is reported to the higher management. For inventory control, ABC and VED analysis is carried out. FEFO (first expiry first out) is followed. The staff includes:

- Assistant Manager
- Executive store
- Assistants
- 2 Health care assistants

The key performance indicators are no stock outs, zero errors in maintenance of accounts, zero error in billing processing, maintain minimum inventory maximum efficiency, maintaining stores as per the NABH = ISO standards, submission of bills accounts within 4 working days, expired items on the shelves should be zero, minimize emergency purchase, TAT suture and lab kits (19 days), instruments (8 weeks) and other items (2 days)

LINEN AND LAUNDRY

The objective linen and laundry is the availability of clean uniforms for patients and staff. Soiled linen when collected is kept in the dirt utility room in a hamper trolley. Infected linen are collected and put in a red bag at the source⁴ of generation. The red bag is sealed and labeled for infection. At the end of each shift, the dirty utility linen is carried in the hamper trolley to the collection room. At the collection point, it is segregated, counted, and sent to the

laundry for washing. The performance indicators are laundry pending, turnaround time for laundry cleaning, percentage discarded linen.

BIOMEDICAL ENGINEERING DEPARTMENT

The main objective of the department is to facilitate the usage of latest technologies in the diagnosis, treatment and care of patients. It is also responsible for proper usage and quality performance of these costly equipment and tools inside the hospital

The department maintains an updated asset register of the hospital equipment, conduct daily rounds to ensure that the equipment is functioning smoothly, responsible for facilitation and identification of equipment requirements, planning technical comparison, ordering installation and deployment units and new projects, conduct regular preventive maintenance servicing for all the equipment at regular intervals, facilitating equipment replacements and condemnation, whenever required, conducting regular training programs for hospital staff, on usage of hospital equipments. The staff consists of HOD, 5 biomedical engineers and 2 biomedical technicians and 4 medical gas technicians.

FOOD AND BEVERAGES

The objectives of food and beverages department are to deliver healthy and nutritious meals coupled with a wonderful experience of hospitality services to all IP, OP and staff. The cafeteria is outsourced to Java Green. The main functions of the department are as follows:

1. Inpatient meal management
2. Purchase of fruits, vegetables, milk, pulses, whole grain and other dietary consumables
3. FIFO is followed

The purchased items are unloaded in the receiving area, where they are inspected and then washed with water and anti-bacterial liquid before bringing it in the kitchen premises. It is followed by storage of perishable and non-perishable items in refrigerator and dry storage area respectively. Diet planning and counselling is done by the dietician according to the patient's condition, food allergy and taste and general preference. The diet summary is

handed over to the supervisor in the form of meal sheet cum ticket. According to this, the food is prepared and laid out on trays. The meals are served in the patients' rooms and clearance is carried out after 2 hours. Food/meal/diet for a patient admitted in the hospital is decided by the doctor admitting the patient depending on his/her medical condition. On doctor's recommendations, the dieticians plan the meal that is best for the patient's speedy recovery. The staff includes:

- Regional head of support function
- F&B manager cum chef
- Assistant manager F&B
- Executives
- Senior Dietician
- Other F&B staff

SECURITY

Services rendered by security department are surveillance and patrolling of the infrastructure and material, access control (in restricted areas like IT, MRD, LSS, Mortuary, Pharmacy, Electric control panels), control of movement of traffic in premises, reception and conduct of visitors and attendants, assistance in fire control and emergency plan, vigilance and intelligence, liaison with sensitive areas, carry out verification, hold records, issue passes, and generate reports on security matters. It is equipped with modern equipment like CCTV's metal and explosive detectors, alarms, security, lighting and walkie-talkies, etc. The staff members are:

- HOD
- Senior officer
- Security supervisor
- Sr. security assistant
- Security guards

The performance indicators are TAT, theft percent, code related incidents.

EDUCATION AND TRAINING FACILITIES FOR NURSES

In line with the vision of continued commitment toward education and training in the field of healthcare, particularly the preparation of highly competent nursing professionals dedicated to patient care, the board of management has upgraded its School of Nursing to a full KDA College of Nursing.

ADMINISTRATIVE SERVICES

ADMISSION AND BILLING:

The admission and billing staff includes 1 H.O.D. and 12 employees. The services offered by the department are registration of a new patient, booking/reservation-bed and O.T, admission, billing, discharge work.

Front office:

The front office is the first point of contact at KDAH. It is manned by duty manager, deputy duty manager, and patient care executive and patient care coordination. There are total 7 front offices in KDAH and there are 2 help desks.

Functions:

- Respond and answer telephone calls from patients and clients (call center).
- Registration of outpatients, in patients and executive health checkup patients for various investigations (registration counter).
- Admission, billing and discharge of in patients.
- Direct the patients and their relatives to the outpatient services and the inpatient wards (helpdesk and welcome desk).
- Report receiving and handling over to the patient (dispatch counter).

Third Party Administrator Desk:

T.P.A. staff includes one executive clinical administrator and 4 Customer care officer.

Functions:

- Counseling
- Pre-Authorization
- Cashless admission
- Query handling
- Final approval

- Maintain privacy and confidentiality

INFORMATION TECHNOLOGY DEPARTMENT:

It is implied that there is central database for entire hospital. Services rendered by the IT department are as follows:

- IT support to location users for hardware and software as per SLA (service level agreement).
- Installation of new IT equipment.
- Helping biomedical department in configuring the medical equipment with HIS.
- Installation of appointment scheduling programs.

The IT staffs include:

- Chief information officer
- Manager IT
- Executive IT engineers.

The performance indicators are calls resolutions within a time limit, strict data security, zero percent variance, in hardware and software variance, minimal occupational hazard and proper e-waste disposal.

ENGINEERING DAPARTMENT:

Engineering and maintenance department is manned for 24 hours for keeping round the clock vigil on proper functioning of plant engineering equipment coming under the purview of department. This covers maintenance of major supplies to the hospital such as power, water, which form the life line to the hospital's activities. The responsibilities of the department include operation and maintenance of plant equipment installed in the basement of main building and various other areas to support the normal functioning of the hospital and repair work of equipment related to the department's responsibility. The policy of the department is to serve well with safety and it time, continuous improvement, cost saving, optimum utilization of manpower and equipment, optimum utilization of inventory and teamwork.

The major engineering services are:

- Electrical power supply- normal and emergency
- Air conditioning, ventilation and refrigeration.
- Steam and hot water supply.
- Water stations and cold water supplies- filtration system.
- Medical gases supplies
- Fire detection alarms and fighting system.
- Internal and external plumbing system.
- Civil works-Masonry, carpentry, glasswork, upholstery, painting, etc.
- PNG and LPG supply.
- Safety assessment of facilities.

MARKETING AND SALES

Marketing and sales department is concerned with business development, branding, promotions and advertisement of KDAH healthcare services. Marketing deals with organizing health check-up camps and awareness talks for corporate or PSU's and RWA, designing all the brochures and signage, conducting CME's/seminars. The sales department deals with PSU's and corporate tie-ups, pitching referral sales from nearby general practitioners and nursing homes, liaison with TPAs and managing the international patients (medical tourism).

FINANCE

The scope of services includes the entire hospital cash handling and cash disbursement in the form of salaries and vendor payment for stores, pharmacy and biomedical department. All the cash collected is deposited on daily basis in the bank. The TPA payment is collected through lump sum amount in the form of cheque at the end of the month. The staffs include :

- HOD
- Asst. Manager
- Senior executives
- Junior executives
- 2 cashiers

PURCHASING DEPARTMENT

Purchasing department is responsible for the procurement of function of the hospital the primary functions of the purchasing department are to:

- Procure the rights and services from the right suppliers at the right time for the right place.
- Receive, warehouse, issue & distribute stocks to hospital departments in accordance with KDH procedure.
- Hospital users and clinicians actively participate in product evaluation processes. The purchasing department is actively involved in cost analysis and supplier performance management. It is through all of these activities that the department manages the chain process.

HUMAN RESOURCE DEPARTMENT

The functions of HR department at KDA hospital are:

- Hiring
- Physician and nurse recruitment
- Employee orientation
- Personal management
- Benefits and compensation management
- Counseling
- Claims handling
- Training and performance monitoring
- Professional development programs
- State and federal regulations education
- Work place safety and sanitation
- Administration – employee meetings
- Staff morale and retention

Recruitment /selection:

- Identifying the key requirements areas(KRA)
- Drafting job description

- Recruitment through job portals and internal references
- Selection
- Medical examination of the candidate
- Offering letter to the selected ones

QUALITY CONTROL DEPARTMENT

The Functions of the department are:

- To analyze patient feedback forms.
- To analyze different parameters from different departments and compare them.
- Infection control of the hospital.
- Induction and training of hospital staff.
- Accreditations (NABH, JCI).

This department also maintains few quality indicators for hospital:

- Medication Errors
- Return of patient within 72hours.
- Return of patient to OT within 48hours.
- Return of patient to ICU within 48hours.
- Number of Needle sticks Injuries.
- Number of blood transfusion reaction.
- Number of Adverse Drug reaction.

Staff:

This department consists of one quality manager who reports directly to the director of hospital.

Six Sigma Approach on Discharge Process Turnaround Time in Kokilaben Dhirubhai Ambani Hospital, Mumbai

Introduction

Discharging patients from the hospital is a complex process that is fraught with challenges. Delayed discharge also called as ‘delayed transfer’ or ‘bed blocking’ is a cause of concern for almost every hospital. Delay in the discharge process is a system level issue, leading to inefficiencies in acute bed usage. [1] A number of cross-institutional complexities contribute to delay in discharge process. It is impossible to resolve this issue without a clear picture of the entire discharge process.

This study is mainly focused on streamlining the current Discharge Process of Kokilaben Dhirubhai Ambani Hospital using the Six Sigma approach. Six Sigma is a tool that uses statistics and brainstorming to reach the root cause of a problem and then find solutions to optimize the output. It can be traced back to 1980s when Bill Smith and Bob Galvin, both of Motorola, Inc. developed the Six Sigma quality improvement process. The idea of Six Sigma is to improve quality so that the number of defects becomes so few that they are statistically insignificant. A defect can be defined as anything that could lead to customer dissatisfaction.

Traditionally Six Sigma has been used in the manufacturing industry. However, it is now being increasingly applied to service organizations including hospitals, financial and educational institutions etc.

Kokilaben Dhirubhai Ambani Hospital & Medical Research Institute is a tertiary care hospital located in Andheri West, Mumbai. It is a 730 bedded multi-specialty hospital which became operational in the year 2009. Since then the hospital has been putting in efforts to implement quality management. The hospital got National Accreditation Board for Hospitals & Health care (NABH) in December 2014 and is looking forward to Joint Commission International (JCI).

Six Sigma strives for perfection. It allows for only 3.4 defects per million opportunities for each product or service transaction. It relies heavily on statistical techniques to reduce defects and measure quality based on data. Its main focus is to reduce potential variability from

processes and products by using continuous improvement methodology that has the following stages: Define, Measure, Analyze, Improve and Control (DMAIC).

Literature Review

Every hospital faces various challenges ranging from government regulations, quality issues, accreditation requirements, keeping abreast with changing technology, higher costs etc. Hospital managers believe that complexity of healthcare system joined with exaggeratedly strict regulations force them to be ineffective.

Discharge process begins from the time the consultant gives his approval for discharging the patient to the time the patient vacates the ward. In healthcare the quality and efficiency are determined by proper flow of information and interaction between healthcare providers. [2] Six Sigma helps in streamlining this process and achieve better results.

The concept of Six Sigma is increasingly being used in healthcare industry for improving quality of services rendered, increasing efficiency and eliminating errors. Increasing patient expectations, involvement of doctors and nurses in management have placed service quality as one of the priorities on healthcare agenda. [3] An example of using Six Sigma process in patient discharge is Sharp Health Care Hospital Systems, where a Six Sigma's DMAIC methodology helped decrease the time taken for discharges patient to leave the hospital from 2.2 hours to about 1.5 hours after physician's order. [4]

In healthcare, patient is a consumer but not a payer. As a result the organization may not be rewarded financially for its quality and innovative technology. [5] In July 2000, Mount Carmel Health (Columbus, Ohio) became the first healthcare organization to implement Six Sigma. [5] It is a common myth that Six Sigma can only be used in the manufacturing industry which is not true. [6] Application of Six Sigma to hospital and healthcare industry has become very common.

Management of discharges is essential to enhance the quality of patient care across all sectors of hospital. Team work with proper coordination and cooperation at all levels of hospital service delivery must be encouraged to ensure that the healthcare is planned, managed and delivered based on patient centered approach which ensures quality and fairness for all. [2]

Based on the literature review, it emerges that Six Sigma can be successfully used to reduce waste and variation and achieve high quality standards that is expected from hospitals. It is a powerful approach to improve the process, reduce costs, increase business profitability and revenue growth.

Purpose of Study

The study is conducted with an aim to streamline the current discharge process of Kokilaben Dhirubhai Ambani Hospital, analyze the reasons for delay in discharge process at each step and finally recommend solutions to maximize output with minimum input of resources for best results. The study will also help find difficulties faced at each level of discharge by patients, nurses and others involved in the process.

Objectives of Study

1. To analyze the existing discharge procedure followed by Kokilaben Dhirubhai Ambani Hospital and the status of Six Sigma application in the hospital.
2. To collect and analyze the data with the help of Six Sigma quality tool DMAIC and find out value added time and non value added time within hospital discharge process.
3. To identify and control Critical to Quality (CTQs) for a successful Six Sigma implementation and suggest steps to control the Turnaround Time (TAT) of the discharge process.

Stages of Study:

Six Sigma is a problem solving tool to improve existing business process by constantly reviewing and retuning the process. To achieve this, Six Sigma uses a methodology known as DMAIC. Each of the five DMAIC phases involves detailed plan that help to guide project leaders through the execution of the quality improvement project. [7] These Key Stages are defined as follows:

- **D**efine the problem
- **M**easure the current performance
- **A**nalyze the root causes of defects
- **I**mprove the performance, modify it to stay within acceptable limits

- **Control** the improved performance, ensure its long term sustenance

Define Phase

Statement of Problem:

To reduce and maintain the turnaround time (TAT) of discharge process, starting from the time the doctor gives the discharge orders to the time the patient vacates the ward.

Project Charter:

Discharge process starts from the time the consultant orders for discharging the patient to the time the patient leaves the ward. Delay in discharge process is a critical bottle neck for efficient patient flow, admission process and bed availability. In addition to this it leads to dissatisfaction among patients and loss of revenue for the hospital.

Project Schedule:

Table 1: Project Plan

Phase	Start	End
Define	13.04.15	15.04.15
Measure	16.04.15	22.04.15
Analyze	23.04.15	25.04.15
Improve	26.04.15	10.05.15
Control	11.05.15	17.05.15

COPIS:

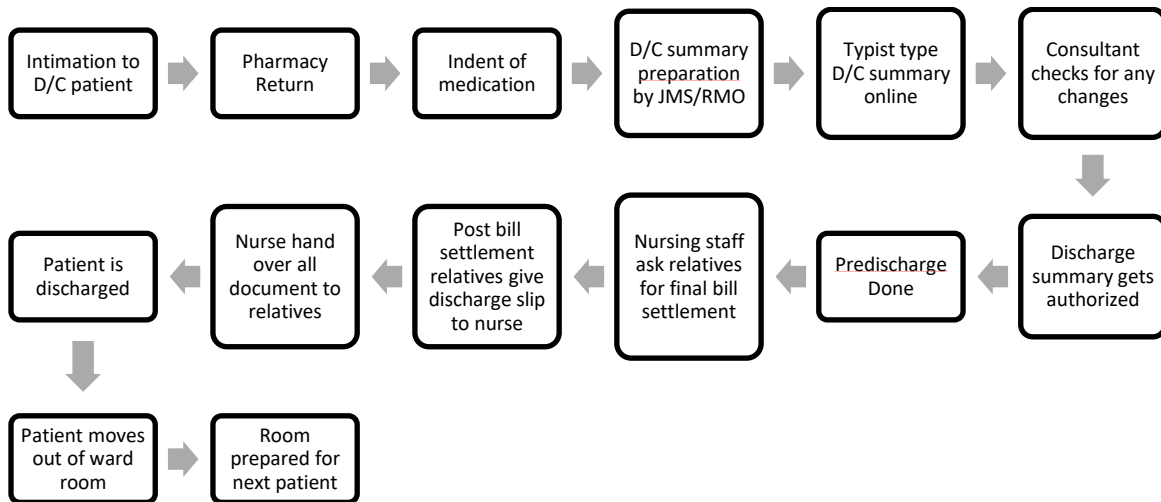
COPIS stands for Customer, Output, Process, Input and Suppliers. The following COPIS

Diagram explains the Discharge Process:

Table 2: SIPOC Diagram explaining the Discharge Process

Customers	Outputs	Process	Inputs	Suppliers
Patient	Patient informed about discharge	Intimation to Discharge Patient	Doctor informs nurse about the discharge	Nurse
Pharmacy	Unused Medicines returned to pharmacy	Pharmacy Return	Nurse returns unused medicines to pharmacy	Nurse
Consultant	D/C Summary prepared	D/C Summary Preparation	Consultant asks JMS/RMO to prepare discharge summary	JMS/ RMO
Nurse	D/C Summary Authorized	Authorization of D/C Summary	Summary forwarded to consultant for authorization	Consultant
Patient	Bill Generated	Pre Discharge	Billing stopped for patient	Nurse
Billing Desk	Bill Settled	Bill Settlement	Bill generated and paid by patient	Patient
Patient	Bed Vacated	Patient Discharged and moves out	Patient vacates the room	Nurse
Nurse	Bed Available for next patient	Room Prepared for next patient	Housekeeping cleans the room	Housekeeping

Process Map



Voice of Customer (VOC)

The “voice of the customer” is a process used to capture the requirements/feedback from the customer (internal or external) to provide the customers with the best in class service/product

quality. [8] It is used to identify the quality attributes needed for a supplied component or material to incorporate in the process or product.

VOC was collected after selecting the key external and internal customers. Patients, family, caregivers were identified as external customers while nurses, doctors, residents, hospital managers were identified as internal customers. Based on feedback and standards the acceptable TAT of discharge process or Upper Specification Limit (USL) was set to 180 minutes. Lower Specification Limit (LSL) was set to 60 minutes. Following is the summary of Voice of Customer collected for the discharge process:

Table 3: Voice of Customer (VOC)

Voice of customer
Time taken for D/C Summary is long Delay in Bill Payment by patient: Procedure/ Therapy advised on the day of discharge leads to delay Delay in vacating the bed post bill settlement Nurses not aware about the discharge process Last moment Pharmacy return Waiting for References from other Doctors Doctors come late for rounds until then Pre- discharge cannot be done

VOC indicated that the discharge process took longer than desirable. Coordination during discharge was identified as another area that required attention. Improvement of communication among hospital staff, patient and his family and others involved with the process needed attention. The study provided valuable information to the hospital management to help them reduce and control Turnaround Time (TAT) for the discharge process and help them achieve higher patient satisfaction and greater revenue generation through increased bed availability and decreased Average Length of Stay (ALOS) of patient in hospital.

Critical to Quality (CTQs)

CTQs are the internal critical quality parameters that relate to the wants and needs of the customer. [8] CTQs defines parameters that are important to the quality of the process or service to ensure the things that are important to the customer are taken care of.

After collecting the VOC members involved with the process of discharge identified the CTQs based on personal experience and observation. CTQs were then translated into measurable projects Critical to Process (CTP).

Table 4: Table showing Critical to Quality (CTQs) requirements derived from VOC

Voice of customer	Response	CTQs
Time taken for D/C Summary is long	6	Doctors come late for rounds until then Pre- discharge cannot be done
Delay in Bill Payment by patient	5	
Procedure/ Therapy advised on the day of discharge	3	
Delay in vacating the bed post bill settlement	7	Delay in vacating the bed post bill settlement
Nurses not aware about the discharge process	0	
Last moment Pharmacy return	3	Delay in Bill Payment by patient:
Waiting for References from other Doctors	4	Problems with billing
Doctors come late for rounds until then Pre- discharge cannot be done	7	Financial Reasons

Table 5: Table showing Critical to Process (CTP) requirements derived from Voice of Business.

Voice of business	Critical to process
TAT to Pre-Discharge the patient is long TAT for D/C Summary is long	TAT to Pre-Discharge the patient is long TAT for vacating the bed post bill settlement is long
Interdepartmental communication and coordination is poor	TAT from pre-discharge to billing is long
TAT from pre-discharge to billing is long	

Proper instructions regarding D/C Process not given TAT for vacating the bed post bill settlement is long	
--	--

Measure Phase

The measure phase has the purpose of mapping the discharge process and establish methodology to narrow down the problem to its major contributing factors. It includes development of data collection plan, data collection and detemining the current performance.

Data Collection Plan

- **Measurement Method** - The timing for each step of the discharge process was recorded using the data collection sheet as per Annexure A.
- **Measurement System Analysis** - The chances of repeatability error were avoided by using a standard data collection sheet.
- **Sampling Method** - A simple random sampling method was used for data collection. Discharge timings for cash discharge patients were recorded. The study did not include insured and corporate patients to eliminate the external factors involved in the process in later case.
- **Sampling Timeframe** - Data was collected for a period of 10 days starting from 9th April, 2015 to 18th April, 2015.
- **Sample Size** - Discharge timings for 90 patients were collected during this period.

The following are the performance statistics regarding the Turnaround Time (TAT) of the current discharge process.

- Sample Size – 90
- Minimum – 40 minutes
- Maximum – 420 minutes
- Mean – 238
- Standard Deviation – 83 minutes
- USL – 180 minutes

- LSL – 60 minutes

Defects Per Opportunity (DPO) and Defect Per Million Opportunity (DPMO)

Defects per Opportunity is the probability of units produced with zero defects by the process. A defect is defined as anything outside of customer specifications while an opportunity is the total quantity of chances for a defect. [9] In discharge process a defect is delay in any of the steps of the process.

	No. of Patients Discharged
Within Standard Discharge Time	23
Above 180 min	67
Total	90

Units – 90

Opportunities – 7

Defects – 67

$$DPO = \frac{\text{Total Number of Defects}}{\text{Total Opportunities}}$$

$$DPO = 9.571428571$$

Defects per million opportunities (DPMO) is the average number of defects per unit observed during the process divided by the number of opportunities to make a defect in the process under study normalized to one million. [8]

$$DPMO = \frac{\text{Number of Defects}}{\text{Number of Units} \times \text{Number of Opportunities}} \times 1000000$$

$$DPMO = 106349.2$$

Current Sigma Level and Process Capability (Cp)

Current Sigma level was calculated using the Yield to Sigma Conversion Table given in Annexure B. 106349.2 defects per million opportunities is equivalent to a sigma performance of between 2.7 and 2.8.

In process improvement efforts, the process capability index or process capability ratio is a statistical measure of process capability: the ability of a process to produce output within specification limits. [10]

$$Cp = \frac{USL - LSL}{6 \times \text{Standard Deviation of the Sample}}$$

$$Cp = 0.240$$

$Cp < 1$ indicates that the process variation is too high and significant number of defects are being made i.e. the process is not capable and does not meet customer expectation and specifications, resulting in customer dissatisfaction.

CT Matrix

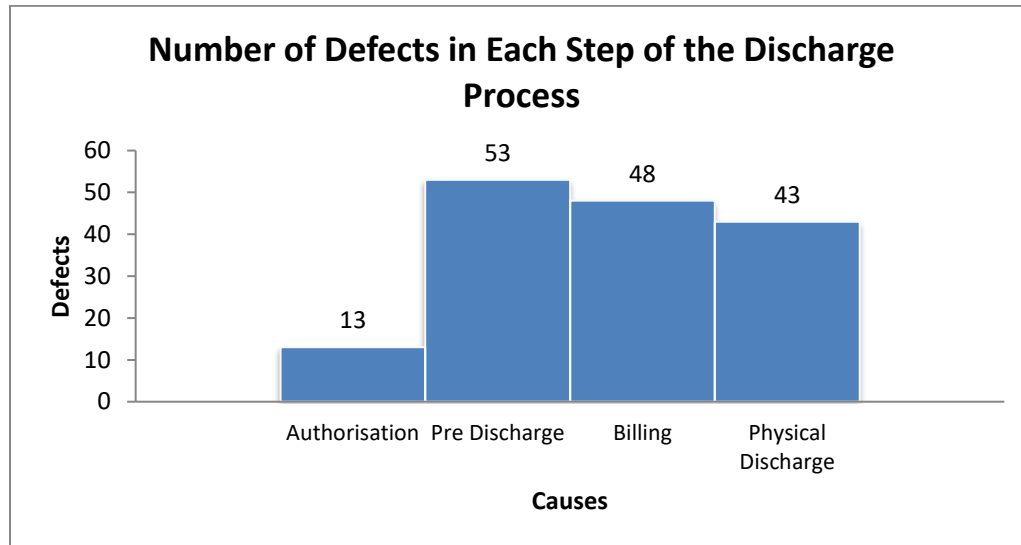
Process Steps		Preparation of Discharge Summary	Pre Discharge	Billing	Physical Discharge
VOC's					
Time taken for Discharge Summary is long	5	5	0	0	3
Waiting for references from other doctors	7	0	5	1	3
Delay in Bill Payment by patient	10	3	5	5	5
Procedure/ Therapy advised on the day of discharge leads to delay	6	1	5	3	5
Delay in vacating the bed post bill settlement	8	3	0	0	5
Nurses not aware about the discharge process	3	3	1	1	1
Last moment Pharmacy return	4	0	3	3	0

Doctors come late for rounds until then Pre- discharge cannot be done	9	5	5	5	0
		139	175	135	159

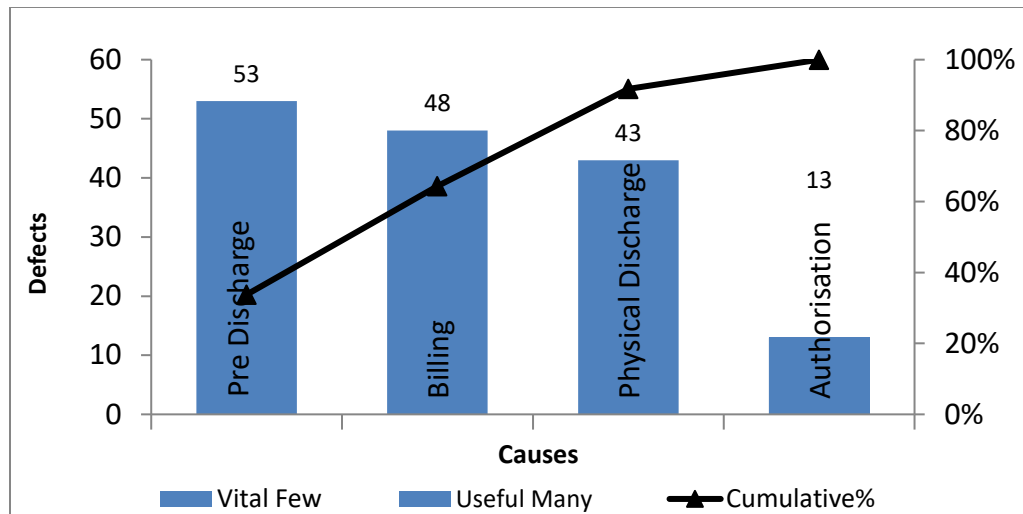
After data collection, the number of defects at each step of the discharge process was calculated and presented below in the form of Pareto Chart. The data revealed that maximum defects occurred in pre discharge followed by billing and physical discharge. Delay due to authorisation was found to be minimum.

Step	Defects
Authorisation of Discharge Summary	13
Pre Discharge	53
Billing	48
Physical Discharge	43

Graph 1: Histogram Showing the Number of Delays in Discharge Process at Each Step



Graph 2: Pareto Chart Showing the Number of Delays in Discharge Process at Each Step



Analysis Phase

The primary objective of analysis phase is to analyze all possible causes, to shortlist major suspected causes (vital few) and to verify root cause. [11] After mapping the entire discharge process in 90 patients, cause and effect diagram (Ishikawa or Fishbone Diagram) was prepared to identify the potential factors causing delay in each critical step of the discharge process.

Table 6: Table showing Standard and Average Timings of each critical step in Discharge Process.

Step	Standard Time	Average Time
Authorization	60 min	90 min
Pre Discharge	30 min	68 min
Billing	60 min	94 min
Physical Discharge	30 min	53 min

Table 7: Table showing Standard and Average Turnaround Time of Discharge Process.

No. of Patients	Standard TAT (Min.)	Average TAT (Min.)	Time Gap
90	180 min	238 min	58 min

Cause and Effect Diagram

The following cause and effect diagrams describe the possible causes for delay at each step of the discharge process.

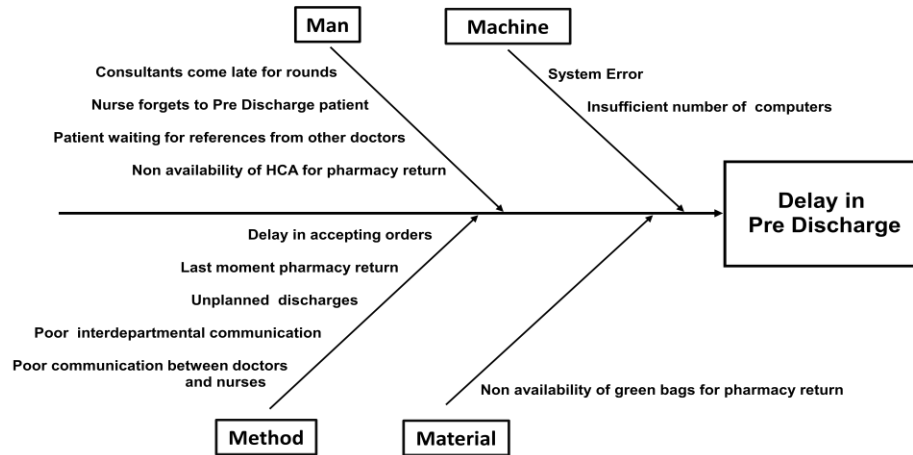


Fig. 1: Cause and Effect Diagram showing Reasons for Delay in Pre Discharge

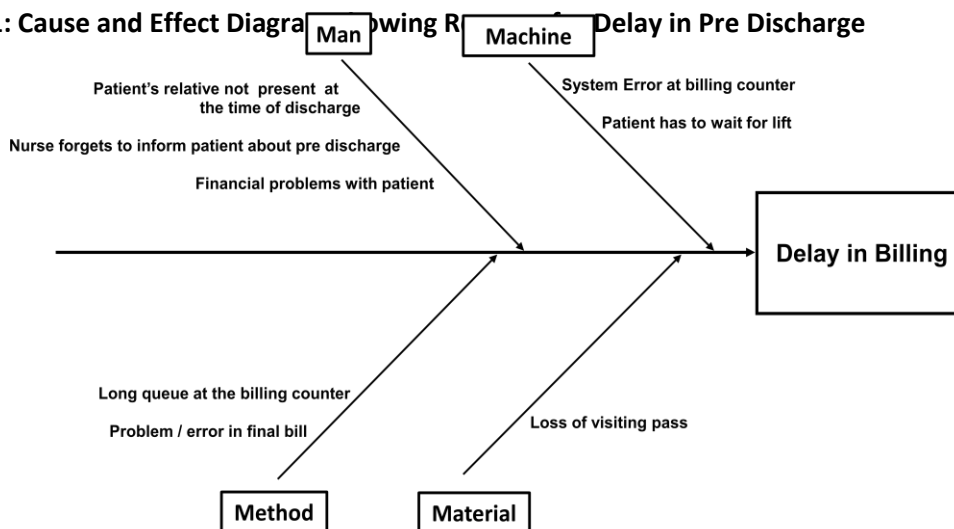


Fig. 2: Cause and Effect Diagram showing Reasons for Delay in Billing

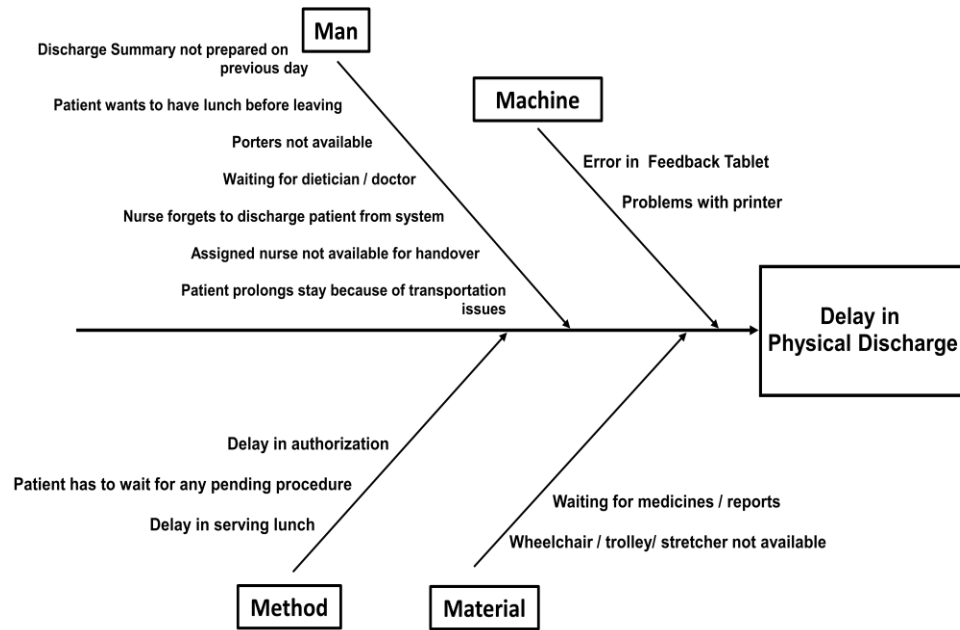


Fig. 3: Cause and Effect Diagram showing Reasons for Delay in Physical Discharge

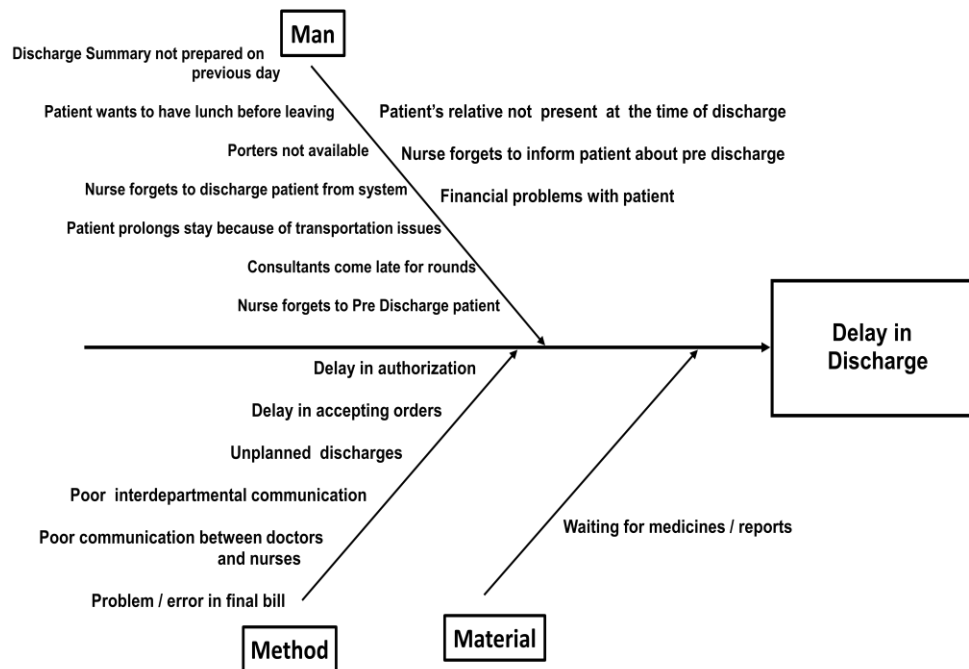


Fig. 4: Cause and Effect Diagram showing main Reasons for Delay in Discharge (to be dealt on priority)

Improve Phase

In Improve Phase recommendation and evaluation of possible improvement solutions for the identified problems was done.

Possible Improvement Solutions

Each problem area was analysed and possible solutions were recommended for each of them. Discharge process was modified to meet customer expectations and remove any wasteful activity leading to delay in the process.

Table 8: Table showing targeted problems and possible solutions

Problems Identified	Possible Solutions	Personnel Involved
Unplanned discharges	All discharges must have a TAT of 3 hours from the time of intimation. Plan of discharge must be prepared at the time of admission itself when the patient is first admitted to the hospital.	Consultants
Poor communication between doctors and nurses	Nurses must call consultants in case of any delay from their side.	Nurses Consultants
Consultants come late for rounds	Setting a time limit for pre discharge even if the consultant comes late for round. Nurses to call the consultant to confirm about pre discharge. Discharge should be planned a day prior so that late rounds do not hinder the entire process.	Consultants Nurses
Nurse forgets to Pre Discharge patient	Training them for proper use of HMIS. Educating the nurses regarding the importance of entering correct and timely data in the system. Checklist Approach (White Board)	Floor Managers Nursing In charges Nurses
Delay in accepting orders	Discharge patients to be given priority. Green bags to be made	Pharmacy In charge Laboratory In charge Team Leader Nurse

	available in sufficient numbers to identify the discharge returns. List of Discharges of the day to be mailed to all concerned departments by 3:00 PM on the previous day.	
Poor interdepartmental communication	Talking to all departments involved with the process and involving them in the process.	Floor Managers
Discharge Summary not prepared on previous day	Involving the typist in the procedure. The typist to inform the nurses and Residents about the authorization and online availability of the D/C Summary respectively.	Typist
Delay in authorization	Discharge summary to be made available online on previous day so that it can be authorized first thing in the morning. Reducing half day's charge from the consultant's pay in case of delay from his side provided all other formalities are cleared. Residents to be made responsible for reminding the consultant about authorization of discharge summary right after it is made available online or before 10 am. Talking to doctors and residents regarding this issue and making them aware of the problems caused by this. In case of delay TL should personally call the consultant to ask him for authorization.	JMS/RMO Typist Consultants Team Leader Nurse
Nurse forgets to inform patient about pre discharge	Assigned staff to be made responsible for this. Checklist Approach (White Board) Educating the nurses about the discharge process and the	Assigned Nurse Team Leader Nurse

	importance of timely discharge of the patient. Informing the patient about their discharge procedure previous day so that they can enquire even if the nurse forgets for some reason.	
Patient's relative not present at the time of discharge	Prior instructions should be given to the patient and their relatives regarding their discharge process and probable time of leaving so that they can make arrangements accordingly. Charging half day's charge from the patient if delay from patient's side for any reason to avoid revenue loss to the hospital. (Half day's charge can be added to the bill which can be refunded to the patient) Charging the patient if he stays beyond the set time of discharge for any reason. (Make sure that all formalities are clear from the hospital's side)	Assigned Nurse Billing Department
Financial problems with patient	Prior instructions should be given to patients regarding their discharge process and probable time of leaving so that they can make arrangements accordingly. Informing them of the probable bill amount 1-2 days before the discharge is planned.	Assigned Nurse Billing Department
Problem / error in final bill	Checking all the entries of the bill before bill generation. Providing the patients with an interim bill which they can check a day prior to discharge to avoid any errors and delay on the day of discharge.	Billing Department
Waiting for medicines / reports	Reports and procedures of discharge patients to be dealt on priority.	Laboratory In charge Pharmacy In charge

Patient wants to have lunch before leaving	Prior instructions should be given to patients regarding their discharge process and probable time of leaving so that they can make arrangements accordingly. Not providing meals to patient if pre Discharge is done before 11:30 AM. Security involvement in Discharge Process.	Assigned Nurse Security
Patient prolongs stay because of transportation issues	Prior instructions should be given to patients and their relatives regarding their discharge process and probable time of leaving so that they can make arrangements accordingly. Charging half day's charge from the patient if delay from patient's side for any reason to avoid revenue loss to the hospital. (Half day's charge can be added to the bill which can be refunded to the patient)	Assigned Nurse Billing Department
Porters not available	Identifying the peak hours of maximum number of discharges and putting in greater number of porters at this time to ensure smooth process.	Porters
Nurse forgets to discharge patient from system	Educating the nurses regarding the importance of entering correct and timely data in the system. Making them aware of their role in the system and how important they are for the system to run smoothly. (Motivation) Filling the timings of each step in the white board as soon as they take place. Team Leader to monitor the entire discharge process and taking note of any delay in the	Floor Managers Nursing Heads Assigned Nurses Team Leader Nurse

	process.	
--	----------	--

The findings and recommendations were presented and discussed with the management and stakeholders involved in the process. With the involvement and cooperation of various stakeholders the recommendations were implemented on pilot basis on selected floor of the hospital and results were analysed. An IEC material was also designed to educate the patient regarding the process of discharge. The analysis showed a marked improvement in the overall discharge process. The findings are as follows:

Table 9: Table showing improvement in each step in the Improve Phase

Step	Time Limit	Baseline Average	Current Average
Authorization of Discharge Summary	12:00 PM	-	-
Pre Discharge	11:30 AM (90 Minutes)	11:26 PM (86 Minutes)	10:51 AM (51 Minutes)
Billing	12:30 PM (60 Minutes)	1:04 PM (94 Minutes)	-
Physical Discharge	1:00 PM (180 Minutes)	1:58 PM (238 Minutes)	12:25 PM (145 Minutes)

Defects Per Opportunity (DPO) and Defect Per Million Opportunity (DPMO)

Data collection was done in order to analyse the effect. DPO and DPMO were again calculated from the collected data.

	No. of Patients Discharged
Within Standard Discharge Time	26
Above 180 min	6
Total	32

Units – 32

Opportunities – 7

Defects – 6

$$DPO = \frac{\text{Total Number of Defects}}{\text{Total Opportunities}}$$

$$DPO = 0.857142$$

Defects per million opportunities (DPMO) is the average number of defects per unit observed during the process divided by the number of opportunities to make a defect in the process under study normalized to one million. [8]

$$DPMO = \frac{\text{Number of Defects}}{\text{Number of Units} \times \text{Number of Opportunities}} \times 1000000$$

$$DPMO = 26785.71$$

Current Sigma Level and Process Capability (Cp)

Current Sigma level was calculated using the Yield to Sigma Conversion Table given in Annexure B. 26785.71 defects per million opportunities is equivalent to a sigma performance of between 3.4 and 3.5.

Control Phase

Sustaining change is often the hardest part of any improvement project. Success requires solid metrics to drive behavior, visibility of progress and strong leadership support. Constant data tracking and documentation needs to be done to come to level of Zero Defect and to keep the process within the specified time of 180 minutes by the hospital authorities. Further the improvement plan needs to be standardized in order to sustain the gains of the improvement.

Results and Discussions

Six Sigma has been in use in the manufacturing industry for long. However, it is now being increasingly applied to service organizations especially in the healthcare sector. The main reason which can be attributed to this is that in any hospital quality is patient centric and is a continuous process which calls for zero defect in the processes. Six Sigma approach not only increases customer satisfaction but also increases productivity and revenue for the organization. In this study, before the improvement phase, 67 defects were found in the TAT of the discharge process and the DPMO was found to be 106349.2 with a sigma level of 2.75. In the post improvement phase, the defects reduced from 67 out of 90 to 6 out of 32 leading to a DPMO of 26785.71 and the process sigma level increased to 3.43.

The Six Sigma with the tools, road map and management processes is essentially a carefully managed process for systematically scheduling and carrying out innovation projects that can be thought, learned and performed with a high degree of success. [2] Its application at Kokilben Dhirubhai Ambani Hospital provides an illustration of the benefits of this approach for process improvement. Though there were a few difficulties faced during the study mainly at the root level because of difficulties in coping up with day to day activities of the involved personnel and implementation of the solutions at all levels was difficult. Yet the study achieved the results through coordination and participation of the management and the stakeholders involved in the process.

References

- [1] K. Bryan, "Policies for reducing delayed discharge from hospital," *Oxford Journal*, vol. 95, no. 1, pp. 33-46, 2010.
- [2] F. A. S. L. Kalyan Vishwanath Reddy, "Six Sigma Approach on Discharge Process Turnaround time in King Khalid Hospital, Hail, Saudi Arabia," *Australian Journal of Basic and Applied Sciences*, vol. 7, no. 14, pp. 523-533, 2014.
- [3] S. S. K. Lam, "SERVQUAL: A tool for measuring patients' opinions of hospital service quality in Hong Kong," *Total Quality Management*, vol. 8, no. 4, pp. 145-152, 1997.
- [4] P. Atkins, "Six Sigma Projects add Efficiency to Discharge: Hospital System Improves Patient Throughput.," *Hospital Home Health*, vol. 25, no. 3, pp. 31-34, 2008.
- [5] S. H. Lin Guo, "Patients are Not Cars and Staff are Not Robots: Impact of Differences

between Manufacturing and Clinical Operations on Process Improvement," *Knowledge and Process Management*, vol. 19, no. 2, pp. 53-68, 2012.

- [6] G. Bruce, *Six Sigma for Managers*, Maidenhead: Mc-Graw Hill, 2002.
- [7] D. M. De Koning, "A rational reconstruction of Six Sigma's breakthrough cookbook," *International Journal of Quality and Reliability Management*, vol. 23, no. 5, 2006.
- [8] "www.isixsigma.com," I-Six Sigma, 2009. [Online]. Available: <http://www.isixsigma.com/dictionary/voice-of-the-customer-voc/>. [Accessed 24th April 2015].
- [9] "www.tutorialspoint.com," [Online]. Available: http://www.tutorialspoint.com/six_sigma/six_sigma_defect_metrics.htm. [Accessed 24 April 2015].
- [10] CapabilityProcess, NIST/Sematech Engineering Statistics Handbook, National Institute of Standards and Technology, Retrieved 2008-06-22..
- [11] N. P. Bhooma Devi, "Reduction of Turnaround Time of Inpatients in a Private Hospital, Chennai: A Six Sigma Approach," *IJEMR*, vol. 1, no. 6, pp. 2249-8672, 2011.

Annexure A – Data collection Sheet

	Elements							
	Patient's Name							
	UID No.							
	Age/ Gender							
	Floor							
	Room No.							
	Consultant							
	Type of Discharge							
1	Intimation to D/C patient	Date						
		Time						
2	Pharmacy Return	Date						
		Time						
3	Indent of medication	Date						
		Time						
4	Nurse calls concerned dept to order for investigation (If any)	Date						
		Time						
5	Order gets Accepted (In case of pending order)	Date						
		Time						

6	D/C summary preparation by JMS/RMO	Date						
		Time						
7	Typist type D/C summary online	Date						
		Time						
8	Consultant checks for any changes	Date						
		Time						
9	D/C summary gets authorized	Date						
		Time						
10	Predischarge Done	Date						
		Time						
11	Nursing staff ask relatives for final bill settlement	Date						
		Time						
12	Post bill settlement relatives give discharge slip to nurse	Date						
		Time						
13	Nurse hand over all document to relatives	Date						
		Time						
14	Patient is discharged	Date						
		Time						
15	Patient moves out of ward room	Date						
		Time						
16	Room prepared for next patient	Date						
		Time						

Annexure B – Yield to Sigma Conversion Table

Yield %	Sigma	Defects Per Million Opportunities
99.9997	6.00	3.4
99.9995	5.92	5
99.9992	5.81	8
99.9990	5.76	10
99.9980	5.61	20
99.9970	5.51	30

99.9960	5.44	40
99.9930	5.31	70
99.9900	5.22	100
99.9850	5.12	150
99.9770	5.00	230
99.9670	4.91	330
99.9520	4.80	480
99.9320	4.70	680
99.9040	4.60	960
99.8650	4.50	1350
99.8140	4.40	1860
99.7450	4.30	2550
99.6540	4.20	3460
99.5340	4.10	4660
99.3790	4.00	6210
99.1810	3.90	8190
98.9300	3.80	10700
98.6100	3.70	13900
98.2200	3.60	17800
97.7300	3.50	22700

97.1300	3.40	28700
96.4100	3.30	35900
95.5400	3.20	44600
94.5200	3.10	54800
93.3200	3.00	66800
91.9200	2.90	80800
90.3200	2.80	96800
88.5000	2.70	115000
86.5000	2.60	135000
84.2000	2.50	158000
81.6000	2.40	184000
78.8000	2.30	212000
75.8000	2.20	242000
72.6000	2.10	274000
69.2000	2.00	308000
65.6000	1.90	344000
61.8000	1.80	382000
58.0000	1.70	420000
54.0000	1.60	460000
50.0000	1.50	500000

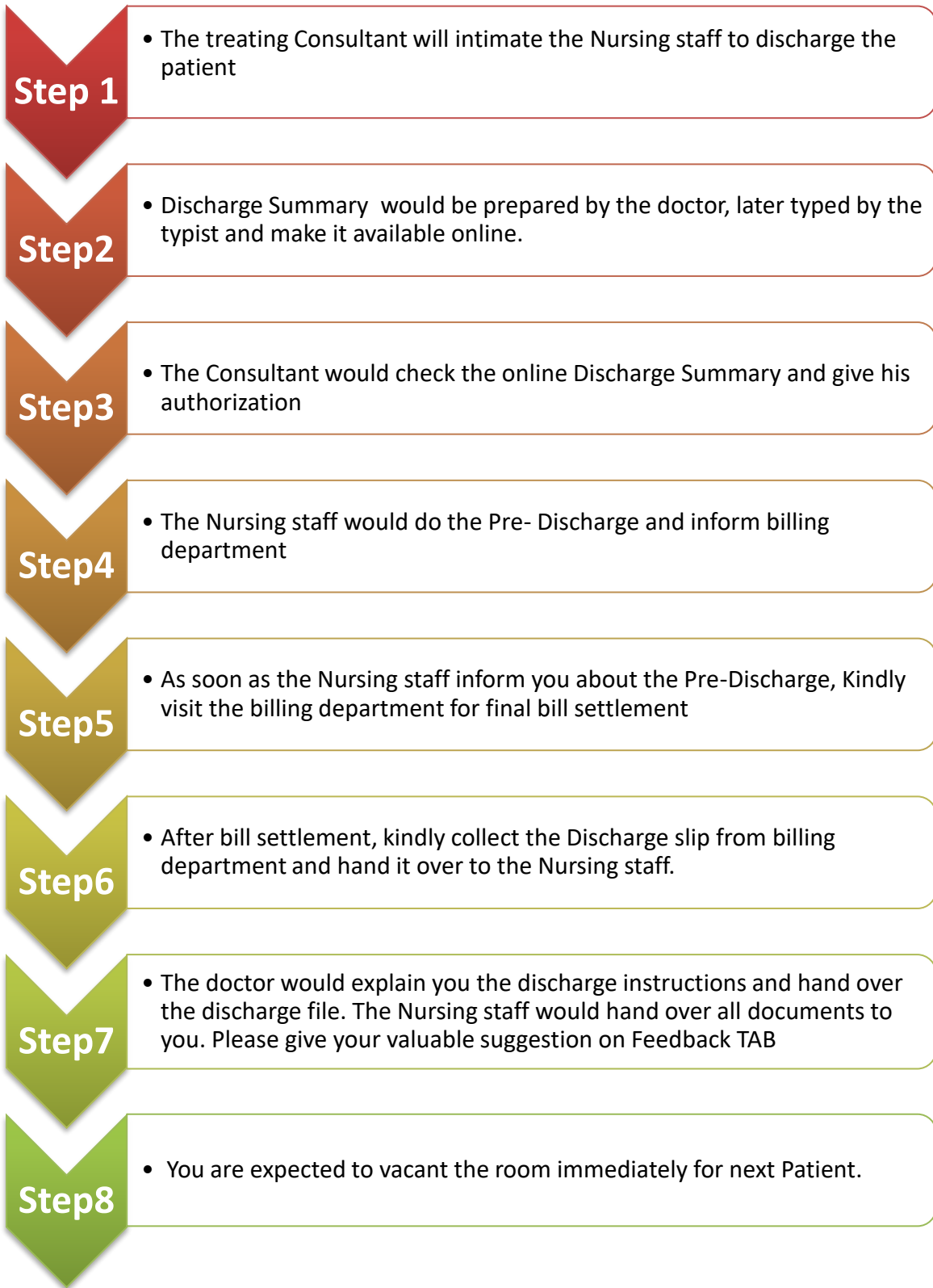
46.0000	1.40	540000
43.0000	1.32	570000
39.0000	1.22	610000
35.0000	1.11	650000
31.0000	1.00	690000
28.0000	0.92	720000
25.0000	0.83	750000
22.0000	0.73	780000
19.0000	0.62	810000
16.0000	0.51	840000
14.0000	0.42	860000
12.0000	0.33	880000
10.0000	0.22	900000
8.0000	0.09	920000

Annexure C – Patient IEC Material on Discharge

डिसचार्ज प्रक्रिया



Steps for Discharge Process



Lean Approach to Reduce Report Turnaround Time in Imaging Department of Kokilaben Dhirubhai Ambani Hospital, Mumbai

Introduction

Ultra Sonography (USG), Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) services in the hospital radiology departments are revenue-generating areas. The reimbursement rates for these services are very high, the scan times (especially in CT) are relatively low, and so the potential for additional revenue to the hospital comes with increasing patient capacity for these services. [1] However, it is also a very competitive time for hospital radiology departments as many outpatient diagnostic centres are being built, drawing patients and physicians to their fast, efficient, no hassles approach to imaging.

Keeping this in mind this study is mainly focused on streamlining the current Process of Report Preparation and Dispatch in the Imaging Department of Kokilaben Dhirubhai Ambani Hospital using Lean Management approach. The concept called “lean management” or “lean thinking” is most commonly associated with Japanese manufacturing, particularly the Toyota Production System (TPS). [2] Much of the TPS way of thinking is based on the work of quality guru W. Edwards Deming, who taught, among other things, that managers should stop depending on mass inspection to achieve quality and, instead, focus on improving the production process and building quality into the product in the first place. [2] Simply put, lean thinking means using less to do more.

Traditionally Lean management has been used in the manufacturing industry. However, it is now being increasingly applied to service organizations including hospitals, financial and educational institutions etc. Principles of lean management can work in health care in much the same way they do in other industries. Infact Lean Thinking is a management strategy that is applicable to all organizations because it has to do with improving processes. All organizations including health care organizations are composed of a series of processes, or sets of actions intended to create value for those who use or depend on them which in healthcare are the patients.

To maximize value and eliminate waste, leaders in health care, as in other organizations, must evaluate processes by accurately specifying the value desired by the user; [3] identifying every step in the process (or “value stream,” in the language of lean) and eliminating non-value-added steps; and making value flow from beginning to end based on the pull — the expressed needs — of the customer/patient. When applied rigorously and throughout an entire organization, lean principles can have a dramatic effect on productivity, cost and quality.

Literature Review

During the last decades, various lean approaches have received much attention and have been successful in improving the productivity, especially in manufacturing, but also other industries perhaps most notably healthcare. [4] Leans provide an approach that cuts across the departments, personalities, hierarchy and complexities of the hospitals. [5]

Service productivity continues to receive ever greater amount of attention as service covers greater portion of the economy. It can be challenging because it often includes both efficiency and customer satisfaction parameter. [6] As competition increases, service productivity becomes increasingly important. [7] Furthermore, different service production processes can vary in degree of customer participation and in demand. [8] The application of lean principles are of greater value to increase the efficiency and customer satisfaction for services with low diversity and low customer participation such as report preparation and dispatch in imaging department of the hospital. The diagnostics imaging department provides “the pictures” - X-rays, computerised tomography scans etc that enables physicians to see and diagnose what is not normally visible. Similarly use of lean in the department make problems visible. [5]

Service productivity in this study consists of efficiency and customer satisfaction. [9] Efficiency refers to efficient use of providers and customer recourses, and customer satisfaction to the extent that customers are satisfied with the outcome the services.

Based on the literature review, it emerges that Lean can be successfully used to reduce waste and achieve high quality standards that is expected from hospitals. It is a powerful approach to improve the process, reduce costs, increase business profitability and revenue growth.

Purpose of Study

The study is conducted with an aim to reduce the Report Turnaround Time of Imaging department at Kokilaben Dhirubhai Ambani Hospital, analyze the reasons for delay in delivery of report and finally recommend solutions to maximize output with minimum input of resources for best results. The study will also help find difficulties faced at each level of report preparation and dispatch.

Objectives of Study

4. To study the existing process of Report Preparation and Delivery followed by the Imaging Department of Kokilaben Dhirubhai Ambani Hospital.
5. To collect and analyze the data and find out the current Report TAT of the Department.
6. To identify value added and non value added activities in the process and suggest steps to reduce the Report Turnaround Time in the Imaging Department of the Hospital.

Stages of Study:

Lean is an integrated approach to utilizing capital, material and human resources to produce just what is needed, when it is needed, in the amount needed with minimum materials, equipment, labour and space. [10] To achieve this, Lean uses five principles. These principles involve detailed plan that help to guide project leaders through the execution of the project. The five principles used in Lean are:

- **Identify Customers and Specify Value**
- **Map the Value Stream**
- **Create Flow**
- **Establish Pull**
- **Pursue Perfection**

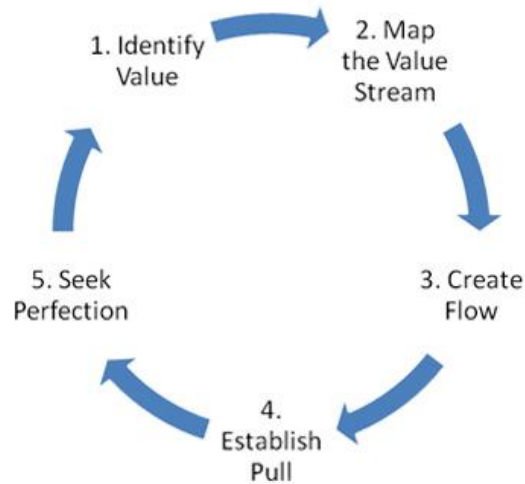


Fig. 1: Figure showing Principles of Lean

Through these principles of Lean the organisation ensures that it is driving towards the overall organisational strategy by constant review of its processes to ensure that it is constantly and consistently delivering value to its customer. This allows the organisation to maintain its high level of service whilst being able to grow and flex with a changing environment and it does this through implementing sustainable change.

Identify Value

The starting point is to recognise that only a small fraction of the total time and effort in any organisation actually adds value for the end customer. By clearly defining Value for a specific product or service from the end customer's perspective, all the non value activities - or waste - can be targeted for removal.

Through this principle we defined "value" for our process of reporting in imaging department. "Value" is any action or process that a customer would be willing to pay for. We identified efforts that add value for the customers and hospital.

Statement of Problem

To reduce and maintain the Report turnaround time (TAT) of Imaging Department, starting from the time the examination is over till the report is dispatched to the Report Dispatch Counter.

Process Map

A Process Map is an organized visualization of all the interrelated activities which combine to form a process. A well understood process can be visualized easily and hence is easy to improve. The basic process was mapped for USG, CT and MRI as depicted in the diagram below.

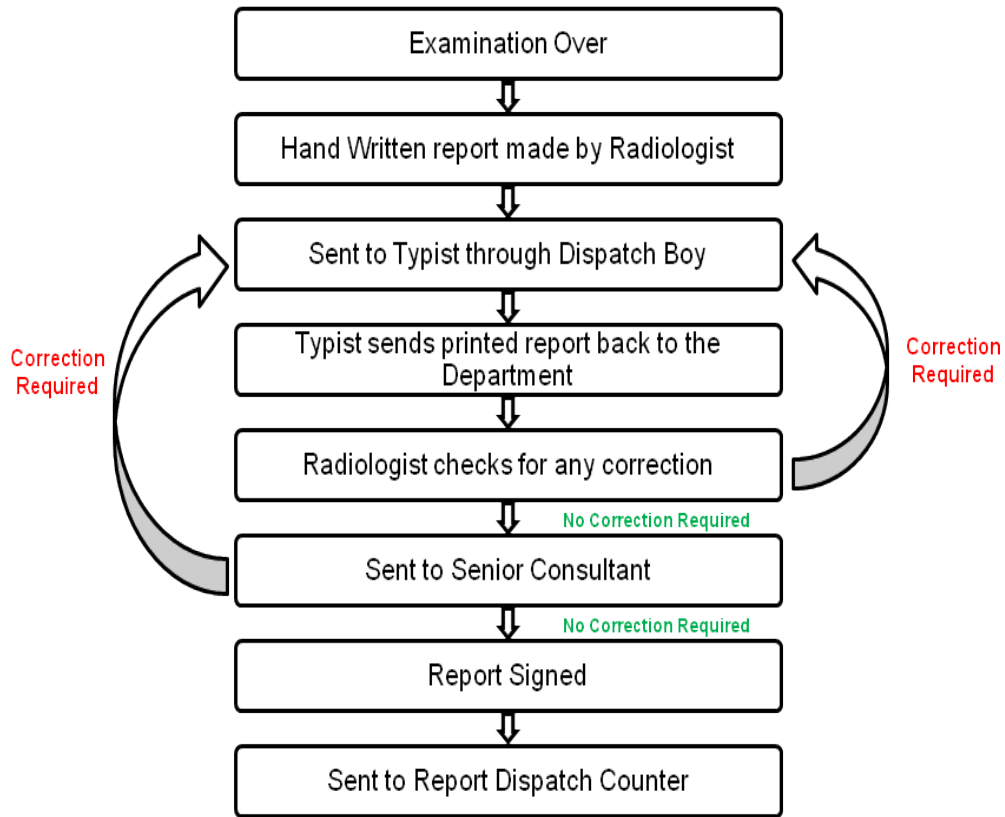


Fig. 1: Figure showing process of Report preparation and dispatch in USG

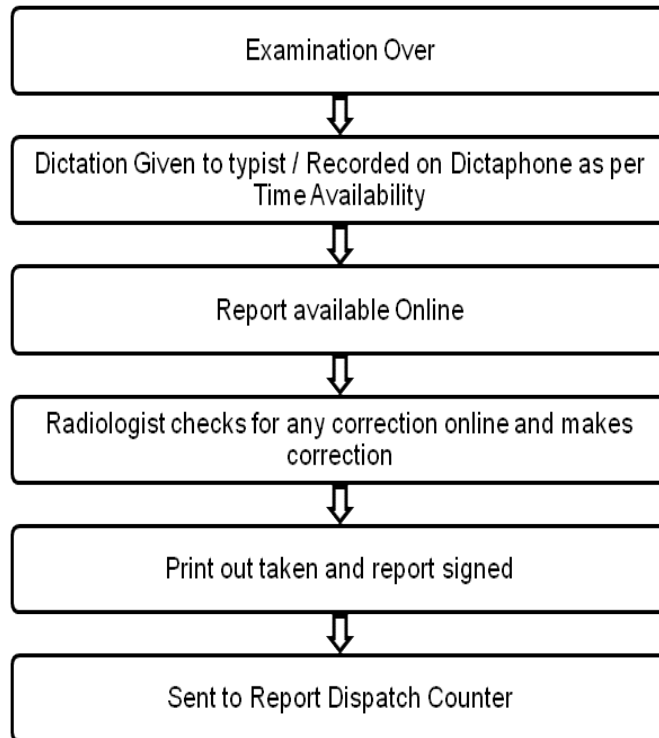


Fig. 2: Figure showing process of Report preparation and dispatch in MRI and CT

Data Collection Plan

- **Measurement Method** - The timing for each step of the Report Preparation was recorded using the data collection sheet as per Annexure A.
- **Measurement System Analysis** - The chances of repeatability error were avoided by using a standard data collection sheet.
- **Sampling Method** – Report Preparation and Dispatch timings were recorded for all OPD patients. The study did not include IPD reports.
- **Sampling Timeframe** - Data was collected for a period of 10 days starting from 9th May, 2015 to 18th May, 2015.
- **Sample Size** – Report Preparation and Dispatch timings were recorded for 101, 59 and 66 patients of USG, CT and MRI respectively.

Performance statistics were recorded for the current Report Turnaround Time of the Imaging Department. The average RTAT was 33 hours, 31 hours and 29 hours for USG, CT and MRI respectively. The minimum, maximum and most reoccurring timings were as follows:

Table 1: Table showing current Report preparation and dispatch statistics in USG

USG	Minimum	Maximum	Average	Mode
Report TAT	10 hrs	77 hrs 30 min	33 hrs 24 min	30 hrs 30 min
Handwritten Report generation time	4 min	4 hrs 15 min	57 min	45 min
Typing Time	13 hrs 40 min	45 hrs 50 min	24 hrs 4 min	22 hrs 45 min
Correction Time	5 min	31 hrs 15 min	4 hrs 10 min	3 hrs 30 min
Dispatch Time	10 min	6 hours	2 hrs 40 min	2 hrs 55 min

In the process of USG report it was observed through data that out of the total Turnaround Time of report preparation, maximum time was taken for typing the report followed by the correction time. Out of 101 reports 22 were sent back for correction. Thus we need to focus on these two steps on priority for TAT reduction.

Table 2: Table showing current Report preparation and dispatch statistics in CT

CT	Minimum	Maximum	Average	Mode
Report TAT	2 hrs 54 min	56 hrs 5 min	31 hrs 57 min	26 hrs 59 min
Report generation time	15 hrs 55 min	30 hrs 45 min	29 hrs 53 min	21 hrs 2 min
Authorization Time	10 min	7 hrs	2 hrs 14 min	1 hr
Dispatch Time	10 min	7 hrs	2 hrs 13 min	30 min

In CT the maximum time was taken for initial report generation after the examination is over. Most of the reports are being made on the next day of examination leading to a high TAT.

Moreover even after the reports are authorized they are being dispatched only at selected time slots of the day.

Table 3: Table showing current Report preparation and dispatch statistics in MRI

MRI	Minimum	Maximum	Average	Mode
Report TAT	20 hrs 39 min	54 hrs 30 min	29 hrs 37 min	26 hrs 55 min
Report generation time	10 min	26 hrs 3 min	8 hrs 7 min	15 min
Authorization Time	0 min	24 hrs	37 min	5 min
Dispatch Time	2 hrs 30 min	53 hrs	22 hrs	24 hrs 30 min

In MRI as opposed to CT and USG maximum time lag was noted between authorization and dispatch of reports. Thus focus needs to be on early dispatch of reports to decrease the total RTAT.

Map the Value Stream

The Value Stream is the entire set of activities across all parts of the organisation involved in jointly delivering the product or service. This represents the end-to-end process that delivers the value to the customer. Once the organisation understands what its customer wants the next step is to identify how the organisation is delivering (or not) that to them.

“Value” and “Waste” were identified at this stage. “Value” is any action or process that a customer would be willing to pay for while “waste” is any useless consumption or expenditure or use without adequate return. Types of waste include: defects, overproduction, waiting, not utilizing, transportation, inventory, motion and extra processing.

Table 4: Table showing Value Stream Mapping of Report preparation and dispatch in USG

Steps	Value Added	Non Value Added
Images saved in Software	Δ	
Examination Over	Δ	
Films printed in Printer Room	Δ	
As per Time availability radiologist sits to write handwritten report		$\emptyset$
Runner goes to Printer Room to collect Films	Δ	
Runner gives the film to Technician in the Department	Δ	
Technicians sorts the Films and attaches them to respective handwritten reports	Δ	
Handwritten Reports sent through Runner to the Typist	Δ	
Typist types the Report	Δ	
Typist Takes a Printout of the Report		$\emptyset$
All printed reports sent to respective Radiologists through runner		$\emptyset$
Junior Consultant makes changes in the report	Δ	

Sent back to Typist for changes		Ø
Typist makes changes and takes a printout		Ø
Junior Consultant Signs the Report	Δ	
Sent for Senior Consultant's Authorization		Ø
Senior Consultant makes changes in the report	Δ	
Sent back to Typist for changes		Ø
Typist makes changes and takes a printout		Ø
Senior Consultant signs the report	Δ	
Reports sent to Dispatch Counter	Δ	

Table 5: Table showing Value Stream Mapping of Report preparation and dispatch in CT and MRI

Steps	Value Added	Non Value Added
Examination Over	Δ	
Images saved in Software	Δ	

Films printed in Printer Room	Δ	
As per Time availability radiologist dictates to typist / records on Dictaphone		$\emptyset$
Typist interprets the dictation on Dictaphone and types the report		$\emptyset$
Report is available online for corrections	Δ	
Consultant makes changes in the report online	Δ	
Printout taken by Consultant	Δ	
Authorization Done	Δ	
Reports sent to Dispatch Counter	Δ	

Create Flow

Creating flow focuses on what is flowing through the process. It eliminated bottlenecks and minimizes buffers. [11]

After mapping the Value Stream, we identified the Non Value added activities (Wastes). Eliminating this waste ensures that the product or service “flows” to the customer without any interruption, detour or waiting.

Table 5: Table showing Non Value added activities in the process of Report preparation and dispatch in USG

Waste Category	Observation	Impact on value-stream performance	Possible solutions from people doing the work
Defects (Producing and Correcting)	Multiple Corrections in the report	Increase TAT of report	A fixed format to be followed by all consultants All corrections to be made online
Waiting (Idle time for patient or staff)	Typist types the report Reports sent to Dispatch Counter just before 5 P.M.	Typing usually done on the next day leading to a delay in report generation Delay in report dispatch	Report to be made online on the day of examination itself Reports to be immediately sent to dispatch counter.
Not Utilizing (The knowledge, skills and capabilities of all employees or available resources)	As per Time availability radiologist sits to write handwritten report Consultant makes correction in hard copies	Delay in sending the report for typing Time is wasted in reviewing the images and writing the report. Wastage of time and resources.	Technicians to assist radiologist while examination Technicians to take notes and prepare handwritten report Corrections to be made online
Motion (Movement by workers)	All printed reports sent to respective Radiologists through dispatch boy	Delay due to unavailability of Radiologist for immediate correction.	Corrections to be made online by the consultant
Extra processing (Unnecessary steps, question or paperwork)	Typist Takes a Printout of the Report Consultant makes correction in hard copies Typist makes changes and takes a	Multiple printouts taken before final report is made.	Corrections to be made online by consultant to avoid multiple corrections and unnecessary paperwork

	printout again		
--	----------------	--	--

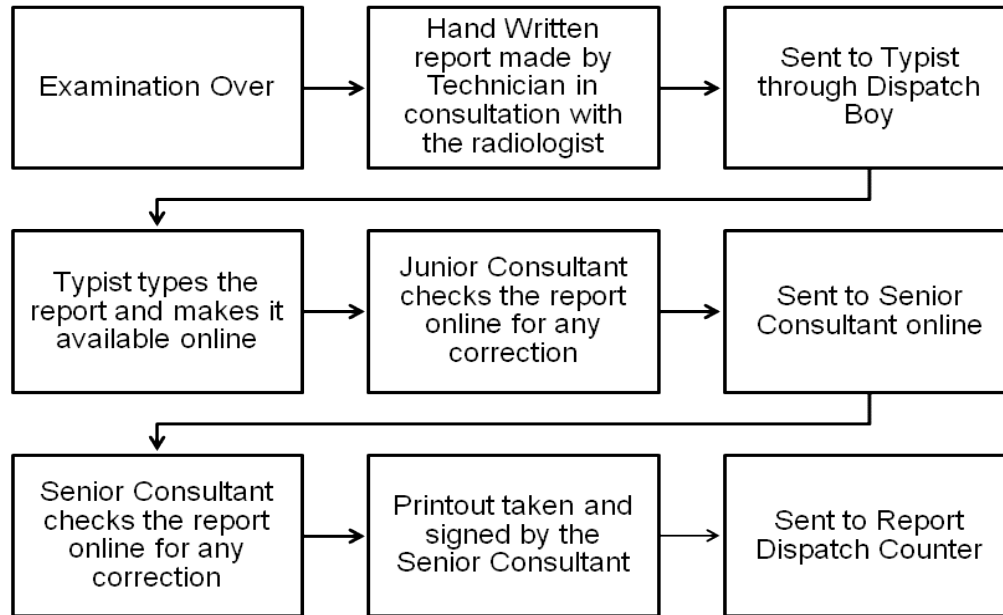


Fig. 3: Figure showing process of Report preparation and dispatch in USG after waste removal

Table 6: Table showing Non Value added activities in the process of Report preparation and dispatch in CT and MRI

Waste Category	Observation	Impact on value-stream performance	Possible solutions from people doing the work
Defects (Producing and Correcting)	Typist interprets the dictation on Dictaphone and types the report	Errors made by the typist that is corrected by the Consultant	Installation of PACS and Voice Recognition System on full scale Consultant dictates immediately to the typist which will save correction time

Waiting (Idle time for patient or staff)	As per Time availability radiologist dictates to typist / records on Dictaphone Even after reports are made they are not sent immediately to dispatch Counter	Dictation/ typing usually done on the next day leading to a delay in report generation Time gap between Authorization of report and dispatch is too high.	Dictation / Recording to be done on the day of examination Reports to be immediately dispatched after authorization.
--	--	--	---

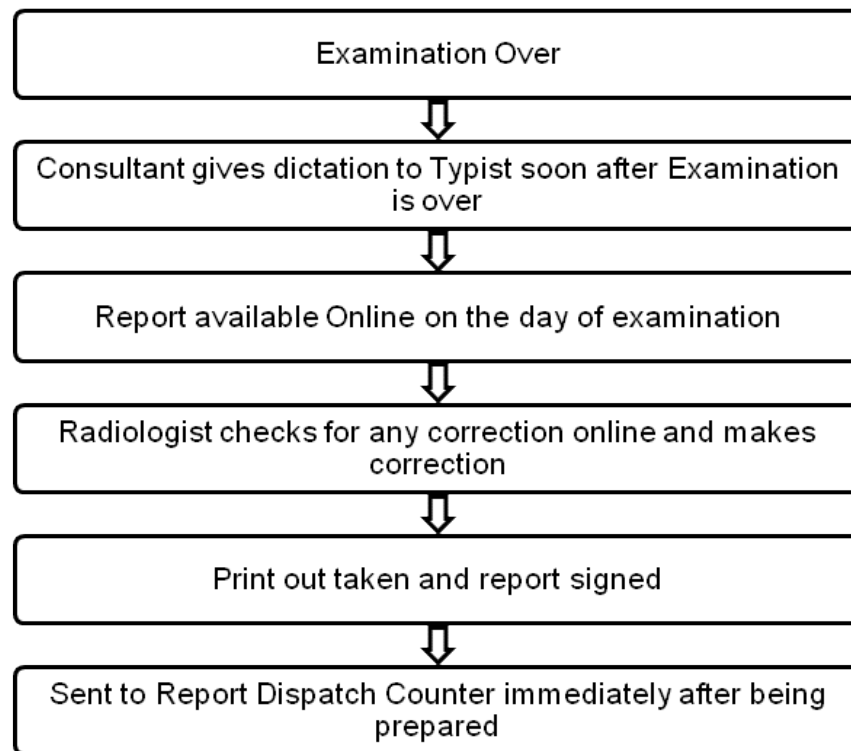


Fig. 4: Figure showing process of Report preparation and dispatch in MRI and CT after waste removal

Establish Pull

This principle is about understanding the customer demand on the service and then creating the process to respond to this. Such that the organisation produces what the customer wants only when the customer wants it. This principle primarily prevails when the customer is rather passive i.e. when a low level of customer participation exists [12] as in the case of report preparation and dispatch where customer participation is minimum.

Our study revealed that the process of report preparation and dispatch in the imaging department of KDAH is not capable of meeting the customers' expectation of timely receiving the test reports thus leading to customer dissatisfaction. Lean provided us the context to discuss problems and processes keeping aside the emotions and encouraged open door communication with stakeholders. So the findings along with recommendations were presented and discussed with the management and stakeholders involved in the process.

Seek Perfection

Creating flow and pull starts with radically reorganising individual process steps, but the gains become truly significant as all the steps are linked together. As this happens more and more layers of waste become visible and the process continues towards the theoretical end point of perfection, where every asset and every action adds value for the end customer. To achieve this the management needs to implement and standardize the improvement plan in order to gain improvement. Constant data tracking and documentation needs to be done to meet the customers' expectation and to keep the process within the specified limits.

Conclusions

Lean Management can successfully be used in a hospital radiology department. Introducing Lean Management can cause initial resistance from the management yet higher productivity and shorter TAT can be achieved. The project suggests that Lean thinking can become an important part of new service development as well as service deployment. An appropriate lean approach as discussed in this study can improve efficiency as well as customer satisfaction.

References

- [1] J. Workman and H. (. Hagg, "Implementing Lean/Six Sigma Methodologies in the Radiology," *American Society for Engineering Education*, vol. 6, no. 26, 2006.
- [2] "www.mater.ie," Mater Mesericordiae University Hospital, [Online]. Available: <http://www.mater.ie/education/materleanacademy/what,is,lean/>. [Accessed 3 May 2015].

- [3] I. f. H. Improvement, "www.ids-healthcare.com," [Online]. Available: http://www.ids-healthcare.com/Common/Paper/Paper_51/Going%20Lean%20in%20Health%20Care1.htm. [Accessed 28 May 2015].
- [4] B. L. D. Souza, "Trends and approaches in lean healthcare," *Leadership in Health Services*, vol. 2, no. 22, pp. 121-139, 2009.
- [5] G. Taninecz, ""Pulling" Lean Through a Hospital," Lean Enterprise Institute, Ontario.
- [6] A. Maroto-Sanchez, "Productivity in the services sector: Conventional and current explanations," *The Service Industries Journal*, vol. 5, no. 32, pp. 719-746, 2012.
- [7] P. Carlborg, D. Kindstrom and C. Kowalkowski, "A Lean Approach for Service Productivity Improvement: Synergy or Oxymoron?," *Managing Service Quality*, vol. 23, no. 4.
- [8] R. Larsson and D. E. Bowen, "Organization and customer: Managing design and coordination of services," *Academy of Management Review*, vol. 2, no. 14, pp. 213-233, 1989.
- [9] C. Gronroos and K. Ojasalo, "Service productivity: Towards a conceptualization of the transformation of inputs into economic results in services," *Journal of Business Research*, vol. 4, no. 57, pp. 414-423, 2004.
- [10] E. Longo, *Principles of Lean Six Sigma and CAPA*.
- [11] D. H. McManus, "Application of Lean to Healthcare Processes: A Complex System Perspective," *Lean Healthcare*, 2012.
- [12] M. J. Bitner, W. T. Faranda, A. R. Hubbert and V. A. Zeithaml, "Customer contribution and roles in service delivery," *International Journal of Service Industry Management*, vol. 3, no. 8, pp. 193-205, 1997.

Annexure A – Data collection Sheet USG

Elements	Name	UID No.	Consultant	Examination Over		Provisional Report Made		Sent to Typist		Typing Done		Sent Back to Department		Sent Back to Typist (In case of any Correction)		Consultant Signs		HOD Signs		Report Dispatched to Counter	
				Date	Time	Date	Time	Date	Time	Date	Time	Date	Time	Date	Time	Date	Time	Date	Time	Date	Time
1																					
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					
11																					
12																					
13																					
14																					
15																					

Data collection Sheet MRI and CT

Elements	Patient's Name	UID No.	Consultant	Examination Over		Report Typed		Authorization		Report Dispatched	
				Date	Time	Date	Time	Date	Time	Date	Time
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											